TOTAL MAXIMUM DAILY LOADS (TMDLs)

For

Fecal Coliform

In

Upper Ocmulgee River Basin

February 2002

EPA
United States
Environmental Protection
Agency

Region 4
serving the
southeast

In compliance with the provisions of the Federal Clean Water Act, 33 U.S.C §1251 et.seq., as amended by the Water Quality Act of 1987, P.L. 400-4, the U.S Environmental Protection Agency is hereby establishing Total Maximum Daily Loads (TMDLs) for fecal coliform for §303(d) listed stream segments in the Upper Ocmulgee River Basin. Subsequent actions must be consistent with this TMDL.

Beverly H. Banister, Director Water Management Division	Date

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LIST OF ABBREVIATIONS

BMP	Best Management Practices
CFS	Cubic Feet per Second
CSO	Combined Sewer Overflow
DMR	Discharge Monitoring Report
DNR	Department of Natural Resources
DWPC	Division of Water Pollution Control
EPA	Environmental Protection Agency
EPD	Environmental Protection Division (State of Georgia)
GIS	Geographic Information System
HSPF	Hydrological Simulation Program - FORTRAN
HUC	Hydrologic Unit Code
LA	Load Allocation
MGD	Million Gallons per Day
MOS	Margin of Safety
MPN	Most Probable Number
MRLC	Multi-Resolution Land Characteristic
NPDES	National Pollutant Discharge Elimination System
NPSM	Nonpoint Source Model
NRCS	Natural Resources Conservation Service
Rf3	Reach File 3
RM	River Mile
STORET	STORage RETrieval database
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
WCS	Watershed Characterization System
WLA	Waste Load Allocation

SUMMARY
Total Maximum Daily Loads (TMDLs)
303(d) Listed Streams in Upper Ocmulgee River Basin - HUC 03070103

State: Georgia

Counties: Gwinnett, DeKalb, Walton, Fulton, Clayton, Rockdale, Newton, Henry, Spalding, Butts, Jasper, Lamar, Monroe, Jones, Crawford, and Bibb.

Major River Basin: Ocmulgee River

Constituent(s) of Concern: Fecal Coliform Bacteria

Summary of 303(d) Listed Waterbody Information and Allocation by Stream Segment

Stream Name	Segment Description	Use Classification	Segment Length (miles)	Drainage Area (miles^2)	WLA (#/30 days) (See Note 1)	LA (#/30 days)	MOS	TMDL (#/30 days)	Percent Reduction
Alcovy River	Cedar Creek to Bay Creek	Fishing/ Drinking Water	4	61.09	0	4.27×10^{12}	4.74×10^{11}	4.74×10^{12}	57
Almand Branch	Tanyard Branch to Snapping Shoals	Fishing	5	9.25	2.84×10^{11}	4.40×10^{11}	4.89×10^{10}	7.73×10^{11}	79
Beaver Ruin Creek	Gwinnett County	Fishing	8	9.58	0	2.80×10^{12}	3.11×10^{11}	3.11×10^{12}	89
Big Cotton Indian Creek	Panther Creek to Brush Creek	Fishing	5	126.26	0	2.02×10^{12}	2.25×10^{11}	2.25×10^{12}	80
Big Flat Creek	Headwaters to Flat Creek	Fishing	13	19.09	1.31×10^{11}	6.41×10^{12}	7.12×10^{11}	7.26×10^{12}	15
Big Haynes Creek	Brushy Creek to Little Panther Creek	Drinking Water	2	33.86	1.14×10^{11}	2.31×10^{12}	2.57×10^{11}	2.68×10^{12}	85
Big Haynes Creek	Headwaters to Brushy Creek	Fishing/ Drinking Water	9	32.14	1.14×10^{11}	2.31×10^{12}	2.57×10^{11}	2.68×10^{12}	85
Big Haynes Creek	Little Haynes Creek to Yellow River	Drinking Water	5	82.28	1.14×10^{11}	2.31×10^{12}	2.57×10^{11}	2.68×10^{12}	85
Big Sandy Creek	Aboothlacoosta Creek to Ocmulgee River	Fishing	10	56.58	1.59×10^{11}	3.61×10^{11}	4.01×10^{10}	5.60×10^{11}	66

Stream Name	Segment Description	Use Classification	Segment Length (miles)	Drainage Area ($miles^2$)	WLA (#/30 days) (See Note 1)	LA (#/30 days)	MOS	TMDL (#/30 days)	Percent Reduction
Bromolow Creek	Headwaters to Beaver Ruin Creek	Fishing	5	10.54	0	6.98×10^{12}	7.75×10^{11}	7.75×10^{12}	74
Cabin Creek	Headwaters Griffin to Towaliga River	Fishing	16	33.83	5.69×10^{11}	3.29×10^{10}	3.66×10^{9}	6.06×10^{11}	72
Camp Creek	Headwaters to Jackson Creek	Fishing	6	7.69	0	2.88×10^{12}	3.20×10^{11}	3.20×10^{12}	74
Cedar Creek	Headwaters to Alcovy River	Fishing	4	6.10	0	1.55×10^{11}	1.72×10^{10}	1.72×10^{11}	52
Falling Creek	Little Falling Creek to Ocmulgee River	Fishing	9	107.74	0	6.81×10^{11}	7.57×10^{10}	7.52×10^{11}	52
Hopkins Creek	Headwaters to Alcovy River	Fishing	4	4.84	0	3.33×10^{11}	3.70×10^{10}	3.33×10^{11}	53
Jacks Creek	Headwaters to Yellow River	Fishing	4	5.17	2.28×10^{11}	1.28×10^{12}	1.42×10^{11}	1.65×10^{12}	15
Jackson Creek	Gwinnett County	Fishing	7	21.50	6.83×10^{11}	8.55×10^{12}	9.50×10^{11}	1.03×10^{13}	74
Little Haynes Creek	Hwy 20 to Big Haynes Creek	Fishing	11	26.56	0	8.40×10^{11}	9.33×10^{10}	9.33×10^{11}	62
Little Stone Mountain Creek	Headwaters to Stone Mountain Lake	Fishing	3	3.11	0	4.80×10^{11}	5.34×10^{10}	5.34×10^{11}	67
Little Suwanee Creek	Tributary to Yellow River	Fishing	2	8.58	0	1.33×10^{12}	1.48×10^{11}	1.48×10^{12}	17
No Business Creek	Headwaters to Norris Lake	Fishing	6	14.43	2.28×10^{11}	1.82×10^{12}	2.02×10^{11}	2.25×10^{12}	69
Pew Creek	Gwinnett County	Fishing	4	30.10	0	1.22×10^{13}	1.35×10^{12}	1.35×10^{12}	12
Ocmulgee River	Beaverdam Creek to Walnut Creek	Fishing	40	974	6.83×10^{12}	7.60×10^{13}	8.44×10^{12}	9.13×10^{13}	88

Stream Name	Segment Description	Use Classification	Segment Length (miles)	Drainage Area ($miles^2$)	WLA (#/30 days) (See Note 1)	LA (#/30 days)	MOS	TMDL (#/30 days)	Percent Reduction
Ocmulgee River	Tobesofkee Creek to Echeconnee Creek	Fishing	10	1396	1.14×10^{13}	8.52×10^{13}	9.47×10^{12}	1.06×10^{14}	90
Rocky Creek	1 mile u/s Rocky Creek Road to Tobesofkee Creek	Fishing	5	50.69	5.46×10^{13}	3.56×10^{11}	3.96×10^{10}	5.50×10^{13}	93
Shetley Creek	Headwaters to Bromolow Creek	Fishing	2	1.29	0	6.17×10^{11}	6.85×10^{10}	6.85×10^{11}	75
Shoal Creek	Headwaters to Alcovy River	Fishing	5	8.33	0	7.31×10^{11}	8.13×10^{10}	8.13×10^{11}	73
Snapping Shoals Creek	Almand Branch to South River	Fishing	10	39.40	2.84×10^{11}	1.41×10^{12}	1.56×10^{11}	1.85×10^{12}	75
South River	Atlanta to Flakes Mill Road	Fishing	16	99.86	1.076×10^{13}	2.73×10^{13}	3.03×10^{12}	3.106×10^{13}	25 (see note 2)
South River	Flakes Mill Road to Pole Bridge Creek	Fishing	9	60.84	1.54×10^{13}	3.90×10^{13}	4.33×10^{12}	5.87×10^{13}	25 (see note 2)
South River	Pole Bridge Creek to Hwy 20	Fishing	15	88.08	1.54×10^{13}	6.39×10^{13}	7.10×10^{12}	8.64×10^{13}	50 (see note 2)
South River	Hwy 20 to Snapping Shoals Creek	Fishing	11	296.89	1.78×10^{13}	1.18×10^{14}	1.31×10^{13}	1.49×10^{14}	35 (see note 2)
South River	Snapping Shoals to Jackson Lake	Fishing	7	47.10	1.78×10^{13}	1.18×10^{14}	1.31×10^{13}	1.49×10^{14}	50 (see note 2)
Stone Mountain Creek	Headwaters to Stone Mountain Lake	Fishing	4	4.05	0	1.55×10^{12}	1.72×10^{11}	1.72×10^{12}	63
Sweetwater Creek	Lee Daniel Creek to Yellow River	Fishing	6	49.12	1.70×10^{12}	1.52×10^{13}	1.68×10^{12}	1.85×10^{13}	79
Swift Creek	Headwaters to Yellow River	Fishing	5	7.93	0	7.17×10^{11}	7.96×10^{10}	7.96×10^{11}	71

Stream Name	Segment Description	Use Classification	Segment Length (miles)	Drainage Area ($miles^2$)	WLA (#/30 days) (See Note 1)	LA (#/30 days)	MOS	TMDL (#/30 days)	Percent Reduction
Tobesofkee Creek (3 segments)	Cole Creek to Rocky Creek	Fishing	18	214.36	2.69×10^{11}	2.82×10^{11}	3.13×10^{10}	5.82×10^{11}	88
Town Branch	Downstream Jackson South WPCP to Aboothlacoosta Creek	Fishing	3	3.64	1.59×10^{11}	1.05×10^{11}	1.17×10^{10}	2.76×10^{11}	97
Turkey Creek	Headwaters to Yellow River	Fishing	4	2.63	0	6.57×10^{11}	7.30×10^{10}	7.30×10^{11}	70
Tussahaw Creek	Wolf Creek to Lake Jackson	Fishing	6	74.35	5.69×10^{10}	3.30×10^{14}	3.67×10^{13}	3.67×10^{14}	71
Walnut Creek	Headwaters to Ocmulgee River	Fishing	20	93.00	0	3.62×10^{11}	4.02×10^{10}	4.02×10^{11}	99
Watson Creek	Headwaters to Yellow River	Fishing	3	3.97	0	9.62×10^{11}	1.07×10^{11}	1.07×10^{12}	70
Wise Creek	Headwaters to Ocmulgee River	Fishing	6	17.30	0	1.61×10^{11}	1.79×10^{10}	1.79×10^{11}	78
Yellow River	Big Haynes Creek to Jackson Lake	Fishing/ Drinking Water	25	566.29	3.00×10^{12}	7.16×10^{13}	7.95×10^{12}	8.25×10^{13}	64
Yellow River	Hwy 124 to Big Haynes Creek	Drinking Water	16	259.54	2.50×10^{12}	5.65×10^{13}	6.28×10^{12}	6.53×10^{13}	64
Yellow River	Sweetwater Creek to Hwy 124	Fishing	16	161.96	2.27×10^{12}	4.51×10^{13}	5.01×10^{12}	5.23×10^{13}	65
Yellow Water Creek	1 mile d/s Stark Road	Fishing	7	31.03	2.05×10^{11}	7.13×10^{10}	7.92×10^{9}	2.84×10^{11}	86
Lake Jackson	Newton, Butts, and Jasper Counties	Recreation	-	650 (see note 3)	See note 4	See note 4	See note 4	See note 4	See note 4

Notes:
1. All future NPDES facilities discharging fecal coliform bacteria shall not cause or contribute to water quality impairment.
2. TMDLs for South River require a 98 percent reduction from the CSOs discharging into Intrenchment Creek and North Branch South River as prescribed in the TMDLs developed by EPD (EPD, 2002).
3. The drainage area for Lake Jackson represents the affected area, as reported on the 2001 303(d) List.
4. The TMDL for Lake Jackson is dependent on water quality improvements in the upstream reaches. Based on the available monitoring data, it was not possible to develop a water quality model to derive a TMDL.

Summary of 1998 303(d) Listed TMDL in Upper Ocmulgee River Basin

Stream Name	Segment Description	Use Classification	Segment Length (miles)	New TMDL
Boar Tusk Creek	Rockdale County	Fishing	3	Yellow River
Brushy Fork Creek	Lake Carlton to Big Haynes Creek	Fishing	5	Big Haynes Creek

Applicable Water Quality Standard for Drinking Water and Fishing use classifications:

Section 391-3-6-.03 (6) of the *State of Georgia Rules and Regulations for Water Quality Control, Chapter 391-3-6 Revised, July, 2000:*
May through October - fecal coliform is not to exceed a geometric mean of 200 per 100 ml based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours. Should water quality and sanitary studies show fecal coliform levels from non-human sources exceed 200 per 100 ml (geometric mean) occasionally, then the allowable geometric mean fecal coliform shall not exceed 300 per 100 ml in lakes and reservoirs and 500 per 100 ml in free flowing freshwater streams.
November through April - fecal coliform is not to exceed a geometric mean of 1,000 per 100 ml based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours and not to exceed a maximum of 4,000 per 100 ml for any sample. The geometric mean standard is the target value for the TMDLs

Applicable Water Quality Standard for Recreation use classification:

Section 391-3-6-.03 (6) of the *State of Georgia Rules and Regulations for Water Quality Control, Chapter 391-3-6 Revised, July, 2000:*
Fecal coliform is not to exceed a geometric mean of 100 per 100 ml for coastal waters or 200 per 100 ml for all other recreational waters, based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours. Should water quality and sanitary studies show fecal coliform levels from non-human sources exceed 200 per 100 ml (geometric mean) occasionally, then the allowable geometric mean fecal coliform shall not exceed 300 per 100 ml in lakes and reservoirs and 500 per 100 ml in free flowing freshwater streams.

TMDL Development - Analysis/Modeling:

The Hydrologic Simulation Program FORTRAN (HSPF) watershed model was used to develop these TMDLs. An hourly time step was used to simulate hydrologic and water quality conditions with results expressed as daily averages. Fecal coliform loading rates from the various sources are based on county population estimates and literature values. A conservative estimate of in-stream decay was assumed in the model. A five-year time period was used to simulate water quality conditions in the South River watershesds and a 10-year time period was simulated in the remaining Upper Ocmulgee River watersheds. These time periods cover a range of precipitation events from which critical conditions were determined for estimating the TMDLs.

**FECAL COLIFORM TOTAL MAXIMUM DAILY LOADS (TMDLs)
for 303(d) listed stream segments in the
UPPER OCMULGEE RIVER BASIN including LAKE JACKSON**

1.0 INTRODUCTION

Section 303(d) of the Clean Water Act requires each state to list those waters within its boundaries for which technology based effluent limitations are not stringent enough to protect any water quality standard applicable to such waters. The TMDL process establishes the allowable loadings of pollutants or other quantifiable parameters for a waterbody based on the relationship between pollution sources and in-stream water quality conditions. This allows water quality based controls to be developed and implemented in an effort to reduce pollution, and restore and maintain compliance with water quality standards.

The TMDLs developed in this report represent the first phase of a long-term process to reduce fecal coliform loading to meet water quality standards in 303(d) listed streams in the Upper Ocmulgee River Basin and Lake Jackson. The reduction scenario proposed for the TMDLs in this document represent one possible allocation scenario that can be used to meet water quality standards. Stakeholders in the impaired watersheds may choose other allocation scenarios to meet the required load reductions. Implementation strategies will be reviewed and the TMDLs will be refined as necessary in the next phase (next five-year cycle). The phased approach will support progress toward water quality standards attainment in the future. In accordance with USEPA TMDL guidance (EPA, 1991), these TMDLs may be revised based on results of future monitoring and source characterization data efforts.

Many of the 303(d) listed streams for which TMDLs have been developed in this report are headwaters streams impaired in part due to pathogens. In January 2002, EPD finalized TMDLs for several streams in the South River basin including: Cobbs Creek, Conley Creek, Doless Creek, Doolittle Creek, Honey Creek, Intrenchment Creek, McClain Branch, North Branch South River, Snapfinger Creek, and Sugar Creek. The TMDLs for these segments can be found in the EPD report entitled "*Total Maximum Daily Loads (TMDLs) for Fecal Coliform in 303(d) Listed Streams in the Ocmulgee River Basin*" (EPD, 2002). For consistency in the development of TMDLs, EPA used the assumptions and models developed by EPD for the South River TMDL.

In 1998, EPA finalized pathogen TMDLs for two 303(d) listed streams in the Upper Ocmulgee River Basin. The streams, Boar Tusk Creek and Brushy Fork Creek, are tributaries to Yellow River and Big Haynes Creek, respectively (see Figure 3). Boar Tusk Creek and Brushy Fork Creek are listed for partially supporting the fishing designated use. The TMDL for Yellow River, from Highway 124 to Big Haynes Creek, supersedes the TMDL for Boar Tusk Creek. The TMDL for Big Haynes Creek supersedes the TMDL for Brushy Fork Creek. Listing information for these watersheds as reported on the 1996 303(d) list are shown in Table 1.

Table 1. 1998 303(d) Listed TMDL in Upper Ocmulgee River Basin

Stream Name	Segment Description	Use Classification	Segment Length (miles)	New TMDL
Boar Tusk Creek	Rockdale County	Fishing	3	Yellow River
Brushy Fork Creek	Lake Carlton to Big Haynes Creek	Fishing	5	Big Haynes Creek

2.0 WATERSHED DESCRIPTION

The Ocmulgee River is located in Central Georgia originating southeast of the City of Atlanta on the downstream side of Lake Jackson, where the South River, the Yellow River and the Alcovy River converge (Figure 1). The Ocmulgee River flows south and southeast for a distance of approximately 160 miles, until it joins the Oconee River near the City of Hazlehurst, to form the Altamaha River. The confluence of the Ocmulgee and Oconee Rivers form the Altamaha River, which continues in a southeaster direction to the Atlantic Ocean. The Upper Ocmulgee River Basin includes three United States Geologic Survey (USGS) eight-digit hydrologic units, HUC 03070103 (Upper Ocmulgee River watershed).

The Ocmulgee River Basin falls within the Level III Piedmont (45) and Southeastern Plains (65) ecoregions. The Upper Ocmulgee River watershed is located in the Level IV Southern Outer Piedmont (45b) subecoregion (EPA, 2000). This region contains mostly rolling to hilly terrain with slightly lower elevations and less relief than 45a; mostly red clayey soils; southern most boundary occurs at the fall line; major forest type is loblolly short-leafed pine.

The Ocmulgee River Basin contains approximately 9,349 miles of Reach File 3 (Rf3) level streams and drains a total area of approximately 6,102 square miles. Watershed land use distribution is based on the Multi-Resolution Land Characteristic (MRLC) databases derived from Landsat Thematic Mapper digital images from the period 1990-1994. MRLC land use in the Upper Ocmulgee River Basin is summarized in Table 2. Figure 2 shows MRLC land use for the 303(d) listed segments in the Upper Ocmulgee River watershed for which a TMDL has been developed in this report. Land use data in some portions of the Upper Ocmulgee watershed in proximity to the metropolitan Atlanta area was modified using a methodology developed by Aqua Terra, Inc. consultants. This methodology reclassified MRLC land use data for some forested areas from “forested” to “built up” based on an analysis of the degree or level of development adjacent to that particular area. This approach was demonstrated to produce a more accurate land use analysis when compared to recent land use data collected and compiled using more detailed and accurate methods than were used in developing the MRLC data. This adjustment was justifiable only for rapidly developing areas around metropolitan Atlanta.

For purposes of calculating fecal coliform loading rates, the MRLC data were summarized into six broad categories: urban pervious, urban impervious, cropland, pastureland, forest and, wetlands. Fecal coliform loading rates were assigned to land coverages based on literature values (NCSU, 1994; EPA, 2001). The loadings from forest and wetlands were assumed to be background. The loadings from urban, cropland, and pasturelands were subject to reductions in the TMDL analysis.

3.0 PROBLEM DEFINITION

EPA Region 4 approved Georgia’s final 2000 303(d) list for the Altamaha, Ocmulgee, and Oconee River Basins in June 2001. Table 3 identifies the waterbodies in the Upper Ocmulgee River Basin as either not supporting or partially supporting designated use classifications, due to exceedence of water quality standards for fecal coliform bacteria. Fecal coliform bacteria are used as an indicator of the potential presence of pathogens in a stream. The objective of this study is to develop fecal coliform TMDLs for 303(d) listed waterbodies in the Upper Ocmulgee River Basin (Figure 3). In accordance with TMDL guidelines (EPA, 1991), the TMDLs are based on readily available published information.

Pursuant to the Consent Decree in the case of Sierra Club v. EPA, 1:94-cv-2501-MHS (N.D. GA), the State or EPA shall develop TMDLs for all waterbodies on the State of Georgia’s current 303(d) List by a prescribed schedule. On June 30, 2001, The Georgia Environmental Protection Division (EPD) developed 11 TMDLs for streams in the Upper Ocmulgee River Basin impaired for fecal coliform bacteria. The TMDLs for the remaining listed segments in the Basin are included in this report.

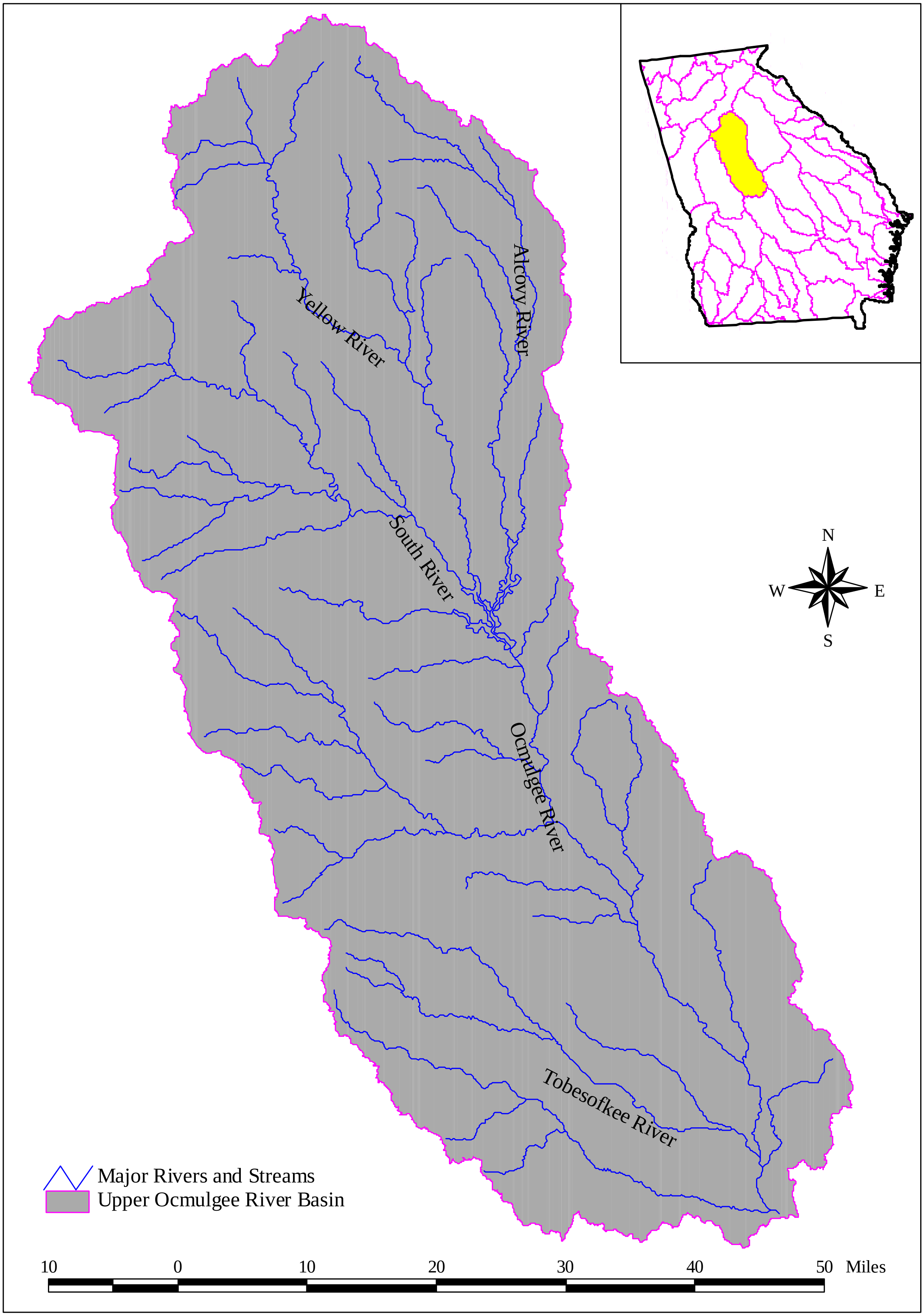

Figure 1. Upper Ocmulgee River Basin.

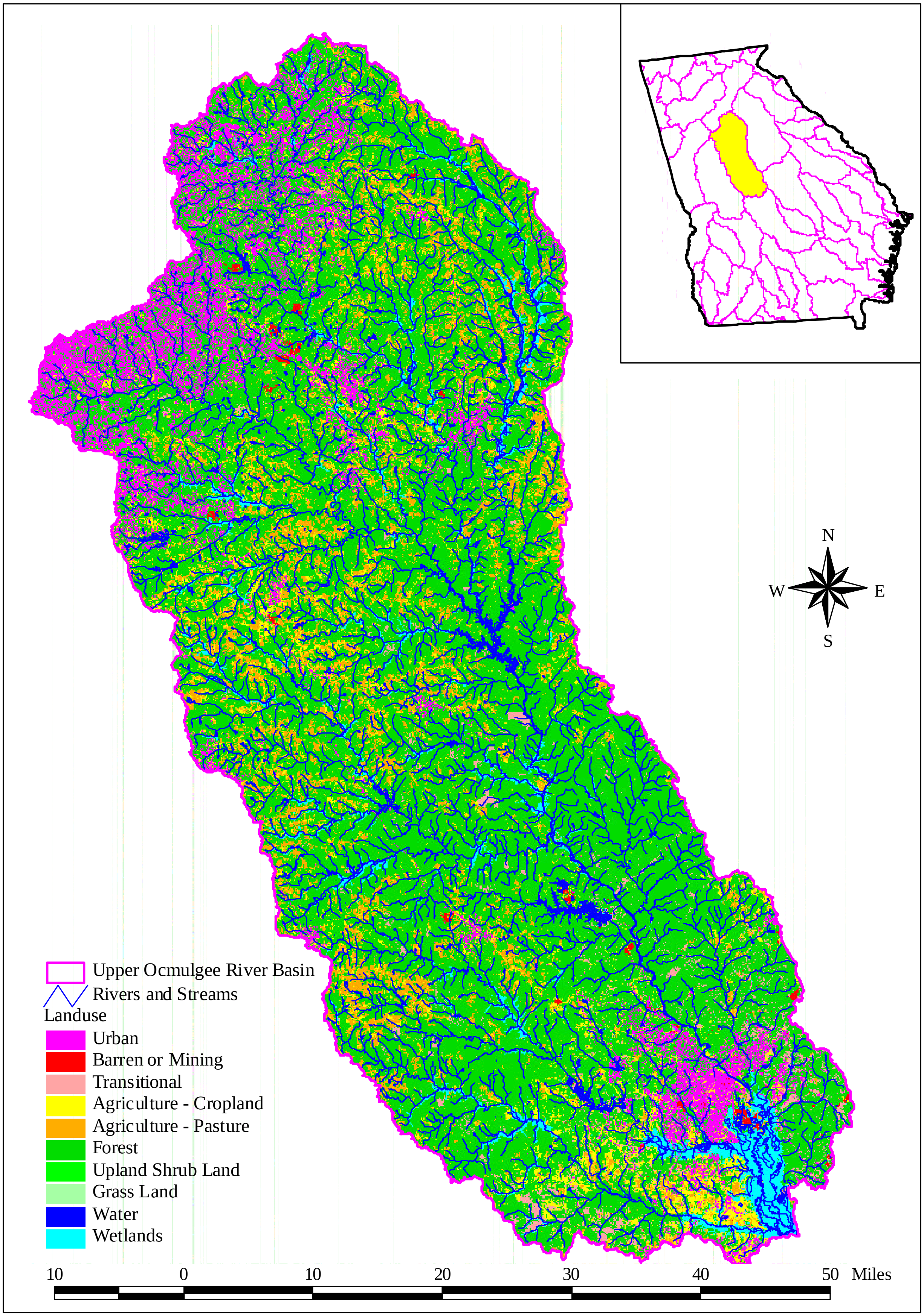

Figure 2. Landuse Distribution, Upper Ocmulgee River Basin.

4.0 TARGET IDENTIFICATION

All of the 303(d) listed waterbodies in the Upper Ocmulgee River Basin, with the exception of Lake Jackson, has a designated use classification of either drinking water or fishing. Lake Jackson has a designated use classification of recreation. The fecal coliform water quality criteria for the use classifications is established by the *State of Georgia Rules and Regulations for Water Quality Control, Chapter 391-3-6 Revised, July, 2000*. These criteria will be used as the target level for fecal coliform TMDL development for all listed segments in the Upper Ocmulgee River Basin.

Section 391-3-6-.03 (6) of the *State of Georgia Rules and Regulations for Water Quality Control, Chapter 391-3-6 Revised, July, 2000,* states that during the months of May through October, when water contact recreation activities are expected to occur, fecal coliform is not to exceed a geometric mean of 200 per 100 ml based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours. Should water quality and sanitary studies show fecal coliform levels from non-human sources exceed 200/100 ml (geometric mean) occasionally, then the allowable geometric mean fecal coliform shall not exceed 300 per 100 ml in lakes and reservoirs and 500 per 100 ml in free flowing freshwater streams. For the months of November through April, fecal coliform is not to exceed a geometric mean of 1,000 per 100 ml based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours and not to exceed a maximum of 4,000 per 100 ml for any sample. The geometric mean standard is the target for the TMDLs. An implicit and explicit MOS is applied to this standard during development of the TMDLs, as detailed in Section 8.3 of this report.

Section 391-3-6-.03 (6) of the *State of Georgia Rules and Regulations for Water Quality Control, Chapter 391-3-6 Revised, July, 2000,* states that for recreational use waters, fecal coliform is not to exceed a geometric mean of 100 per 100 ml for coastal waters or 200 per 100 ml for all other recreational waters, based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours. Should water quality and sanitary studies show fecal coliform levels from non-human sources exceed 200 per 100 ml (geometric mean) occasionally, then the allowable geometric mean fecal coliform shall not exceed 300 per 100 ml in lakes and reservoirs and 500 per 100 ml in free flowing freshwater streams.

The geometric mean criterion of 200 counts/100mL is the primary target value for the TMDLs. The State of Georgia does not have an instantaneous fecal coliform criterion for the summer months when water contact activities are expected to occur. Therefore, the geometric mean is the only applicable criterion to show compliance with the designated use. In the South River watershed TMDLs, simulated concentrations are expressed in terms of a six-year geometric mean plot, as this is the extent of available data from combined sewer overflows (CSOs). CSOs are considered a prime contributor to water quality impairment in the South River. For the other Upper Ocmulgee River watersheds, a ten-year time period was simulated. The purpose of the long term time period is to show that the proposed reductions comply with the geometric mean standards and to illustrate standards have been met for all seasons.

To address uncertainty in the model, a margin of safety (MOS) of 10 percent of the load allocation is included in the TMDLs. In addition, an explicit MOS was included in several of the TMDLs as the simulated peak geometric mean concentration during the critical period was reduced to less than the target. As an example, in the Yellow River TMDL, the simulated peak concentration for the allocation scenario was reduced to about 140 counts/100mL, or 60 counts below the criteria of 200 counts/100mL. This represents a MOS of about 30 percent.

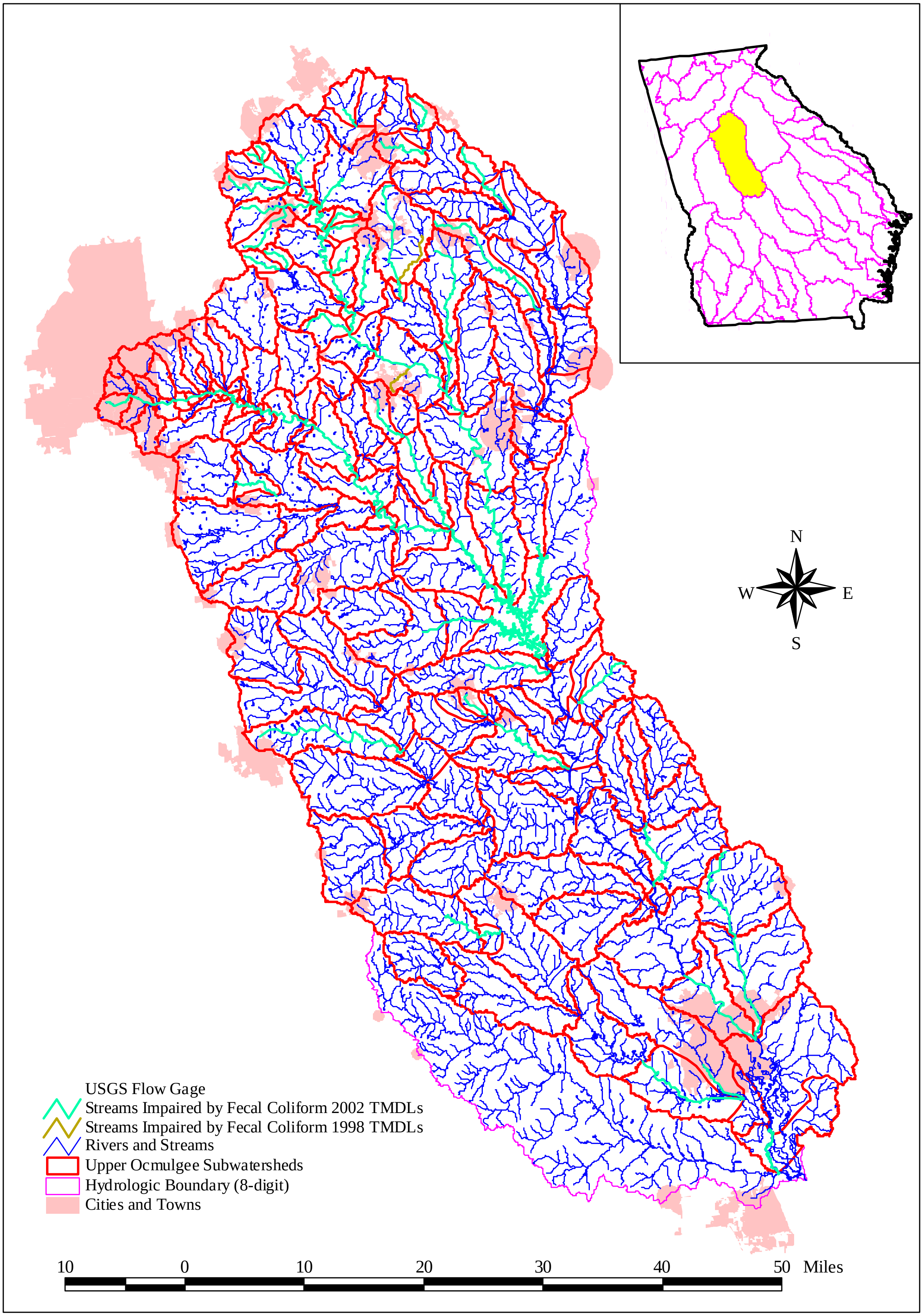

Figure 3. Subwatersheds and 303(d) Listed Streams, Upper Ocmulgee River Basin.

5.0 WATER QUALITY ASSESSMENT AND DEVIATION FROM TARGET

Compliance with the applicable fecal coliform water quality criteria was assessed for each 303(d) listed waterbody, based on water quality data collected from the monitoring stations listed in Table 4.

Water quality data collected during calendar year 1999 for the 303(d) listed stream segments are summarized in Table 5. A geometric mean in excess of 200 counts per 100 milliliters during the period May – October, or in excess of 1000 counts per 100 milliliters during the period November – April, provides a basis for adding a stream segment to the 303(d) List. A single sample in excess of 4000 counts per 100 milliliters can also provide a basis for adding a stream segment to the 303(d) List. Stream segments that do not have 1999 monitoring data exceeding the above geometric mean or single sample criterion were placed on the 303(d) List as a result of data collected prior to 1999.

Several stream segments of Big Haynes Creek and Beaver Ruin Creek were placed on the 303(d) List based on fecal coliform levels reported by Gwinnett County from accidental spills from municipal water pollution control plants. It was not possible to use these data to calibrate the water quality model rather the data were used to assess water quality conditions in the streams. The calibrations of these models were based on data collected by the USGS during routine monitoring on Big Haynes Creek and Beaver Ruin Creek.

6.0 SOURCE ASSESSMENT

An important part of the TMDL analysis is the identification of source categories, source subcategories, or individual sources of fecal coliform bacteria in the watershed and the amount of loading contributed by each of these sources. Sources are broadly classified as either point or nonpoint sources. Point sources comprise the waste load allocation (WLA) component of the TMDL whereas nonpoint sources comprise the load allocation (LA) component of the TMDL.

A point source can be defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. Point source discharges of industrial wastewater and treated sanitary wastewater must be authorized by National Pollutant Discharge Elimination System (NPDES) permits. NPDES permitted facilities discharging treated sanitary wastewater are considered primary point sources of fecal coliform bacteria. These facilities include wastewater treatment plants, CSOs, and smaller facilities, such as state parks, that treat wastewater.

Nonpoint sources of fecal coliform bacteria are diffuse sources that cannot be identified as entering a waterbody through a discrete conveyance at a single location. These sources generally, but not always, involve accumulation of fecal coliform bacteria on land surfaces and washoff as a result of storm events. Typical nonpoint sources of fecal coliform bacteria include:

- Wildlife
- Land application of agricultural manure
- Livestock grazing
- Leaking septic systems
- Urban development (including leaking sewer collection lines)
- Animals having access to streams

6.1 Point Sources

There are numerous permitted point source discharges located in the drainage areas of the 303(d) listed stream segments. These facilities are primarily municipal water pollution control plants (WPCP). In addition, three combined sewer overflow (CSO) facilities are located in the headwaters of the South River in Fulton and Dekalb counties. The average discharge flow and flow-weighted average fecal coliform loading for the NPDES facilities, as calculated from CY1999 Discharge Monitoring Report (DMR) data were provided by EPD and are summarized in Table 6. Design flows, and fecal coliform loading based on monthly fecal coliform permit limits, are also provided in Table 6. In the water quality models, the fecal coliform loading rates from these facilities (with the exception of the CSOs) was calculated using the design flow and the permit concentration of 200 counts/ 100 ml. This load is considered a conservative estimate of the WLA component as most of the NPDES facilities discharging fecal coliform use disinfection prior to discharge.

CSO facilities are currently under a consent decree (EPA, 1999) to meet end-of-pipe criteria for fecal coliform bacteria by 2007. The CSOs are permitted to discharge only under high flow conditions with the WPCP facilities operating at full capacity. In the water quality models, actual discharge and load data provided by EPD were used to model the CSOs.

6.2 Nonpoint Source Assessment

6.2.1 Wildlife

Wildlife deposit feces onto land surfaces where it can be transported during storm events to nearby streams. In the water quality model, the wildlife fecal coliform contribution is accounted for in the deer population, as population estimates of raccoons, waterfowl, and other wildlife are not readily available. The deer population is estimated to be 30 to 45 animals per square mile in this area (Georgia WRD, 1999). The upper limit of 45 deer per square mile has been chosen to account for deer and all other wildlife present in the watershed. It is assumed that the wildlife population remains constant throughout the year, and that wildlife is uniformly distributed on all land classified in the MRLC database as forest, pasture, cropland, and wetlands. The fecal coliform concentration assigned to deer is approximately 5.0×10^8 counts/animal/day (EPA, best professional judgment). The resulting load attributed to wildlife is about 3.5×10^7 counts/acre-day.

6.2.2 Agricultural Animals

Agricultural animals are also a potential source of several types of fecal coliform loading to streams in the Upper Ocmulgee River Basin. Livestock data are reported by county and published by the USDA in the Census of Agriculture (USDA, 1997). The available livestock data include population estimates for cattle, beef cows, dairy cows, hogs, sheep, and poultry (broilers and layers). Livestock data for the counties comprising the 303-(d) listed streams are shown in Table 7. Cattle numbers reported in the census data also represent other breeds of cattle and calves in addition to dairy and beef. Assumptions regarding agricultural animals and resource management practices were provided by NRCS (USDA, 2001) and are summarized as follows:

- As with wildlife, agricultural livestock grazing on pastureland or forestland deposit their feces onto land surfaces where it can be transported during storm events to nearby streams.

- Confined livestock operations also generate manure, which can be applied to pastureland and cropland as a fertilizer. Processed agricultural manure from confined hog, dairy cattle, and some poultry operations is generally collected in lagoons and applied to land surfaces during the growing season, at rates which often vary on a monthly basis. Data sources for agricultural animals are tabulated by county and are based on information obtained from the Census of Agriculture (USDA, 1997). Fecal coliform loading rates for livestock in the watershed are estimated to be: 1.06×10^{11} counts/day/beef cow, 1.24×10^{10} counts/day/hog, 1.04×10^{11} counts/day/dairy cow, 1.38×10^{8} counts/day/layer chicken, and 1.22×10^{10} counts/day/sheep (NCSU, 1994).

- Agricultural livestock and other unconfined animals (i.e., deer and other wildlife) also often have direct access to streams that pass through pastures. Feces deposited into these streams by grazing animals are included in the water quality model as a point source having constant flow and concentration. To calculate the amount of fecal coliform bacteria introduced into streams by cattle, it is assumed that 50 percent of the beef cows in the watershed have access to the streams, and of those, 25 percent defecate in or near the stream banks during a portion of the day (personal communication, EPA, Georgia Agribusiness Council, NRCS, University of Georgia, et. al.). The resulting percentage of time fecal coliform bacteria is discharged into the stream from grazing animals is 0.025 percent.

Assumptions regarding manure management practices for specific agricultural livestock operations areas are similar to those used to develop the TMDLs for the South Georgia Four Basins in 2000 and include:

- Poultry litter is normally piled for a period before it is applied to the land. Within the Upper Ocmulgee River Basin it is estimated that approximately 60 percent of poultry litter (i.e., broiler and layers) is applied to pastureland and 40 percent is applied to cropland. It is assumed that the poultry litter is applied primarily during the period between March and October (inclusive), and that application rates vary monthly.

- Hog farms in the Upper Ocmulgee River Basin operate by confining the animals or allowing them to graze in small pastures or pens. It is assumed that all of the hog manure produced by either farming method is applied to available pastureland, with negligible amounts applied to cropland. Application rates of hog manure to pastureland vary monthly according to management practices. Manure is applied during the period between March and October (inclusive).

- On dairy farms, the cows are confined for a limited period each day during which time they are fed and milked. This is estimated to be four hours per day for each dairy cow. It is assumed that 60 percent of manure collected during confinement is applied to pastureland and 40 percent is applied to cropland. It is also assumed that the dairy cow manure is applied during the period between February and October (inclusive), as well as in November. Application rates vary monthly according to management practices.

- Beef cattle are assumed to be in pasture year round. Therefore, beef cow manure is applied only to pastureland and at a constant monthly rate. This rate varies between watersheds, as the rate is a function of the number of beef cows in the watershed.

6.2.3 Leaking Septic Systems

Fecal coliform loading in the Upper Ocmulgee River Basin may also be attributed to septic system failures. Loading rates are based on estimates from county census data of people in each listed stream watershed utilizing septic systems and literature values for fecal coliform concentrations in human waste. These estimates were updated based on a county-by-county survey conducted by EPD in April-May 2001. It is estimated that there are approximately 2.37 people per household on septic systems (EPA, best professional judgment). For modeling purposes, it is assumed that ten percent of the septic systems in the watershed leak. Leaking septic systems are included in the water quality model as a point source having constant flow and load. The average fecal coliform concentration of the septic system wastewater reaching a stream was assumed to be 1 x 10^4 counts per 100 ml (EPA, 2001).

6.2.4 Urban Development

Fecal coliform loading from urban areas is potentially attributable to multiple sources including storm water runoff, leaks and overflows from sanitary sewer systems, illicit discharges of sanitary waste, runoff from improper disposal of waste materials, leaking septic systems, and domestic animals. Urban runoff and storm water processes are considered to be significant contributors to fecal coliform concentrations in some Upper Ocmulgee River subwatersheds.

7.0 ANALYTICAL APPROACH

Establishing the relationship between in-stream water quality and source loading is an important component of TMDL development. It allows the determination of the relative contribution of sources to total pollutant loading and the evaluation of potential changes to water quality resulting from implementation of various management options. This relationship can be developed using a variety of techniques ranging from qualitative assumptions based on scientific principles to numerical computer modeling. In this section, the numerical modeling techniques developed to simulate fecal coliform bacteria fate and transport in the watershed are discussed.

7.1 Model Selection

A dynamic computer model was selected for fecal coliform analysis in order to: a) simulate the time varying nature of fecal coliform deposition on land surfaces and transport to receiving waters; b) incorporate seasonal effects on the production and fate of fecal coliform bacteria; and c) identify the critical condition for the TMDL analysis. Several computer-based tools were also utilized to generate input data for the model.

The Nonpoint Source Model (NPSM) is a watershed model capable of simulating nonpoint source runoff and associated pollutant loadings, account for point source discharges, and performing flow and water quality routing through stream reaches. NPSM is based on the Hydrologic Simulation Program - Fortran (HSPF). In these TMDLs, NPSM was used to simulate point source discharges, simulate the deposition and transport of fecal coliform bacteria from land surfaces, and compute the resulting water quality response. In-stream decay of fecal coliform bacteria is included in the model at a rate of 0.048 per hour. This rate represents the median value reported in the literature (EPA, 1985), that reports decay rates from 0.008 per hour to 0.13 per hour.

In addition to NPSM, the Watershed Characterization System (WCS), a geographic information system (GIS) tool, was used to display, analyze, and compile available information to support water quality model simulations (EPA, 2001). This information includes land use categories, point source dischargers, soil types and characteristics, population data (human and livestock), and stream characteristics. Results of the WCS characterization are input to a spreadsheet developed by Tetra Tech, Inc. to estimate NPSM input parameters associated with fecal coliform buildup (loading rates). The spreadsheet is also used to estimate direct sources of fecal coliform loading to water bodies from leaking septic systems and animals having access to streams. Information from the WCS and spreadsheet tools were used as initial input for variables in the NPSM model.

7.2 Model Set Up

The Upper Ocmulgee River Basin was divided into 21 projects with each project containing between 7 and 13 delineated subwatersheds. The delineated watersheds correspond to the 12 digit HUCs established by the State of Georgia and are shown in Figure 3. Watershed delineation was based on the Reach File 3 (Rf3) stream coverage and Digital Elevation Model (DEM) data. This discretization allows management and load reduction alternatives to be varied by subwatershed.

The impaired watersheds below Lake Jackson were modeled independently of the watersheds above the lake. Monitoring data obtained from USGS gage 02210500, located at the downstream dam of Lake Jackson, was used to estimate the flow discharging into the Ocmulgee River. The fecal coliform loading into the Ocmulgee River was estimated based on average flow and permit limits for concentration.

An important factor influencing model results is the precipitation data contained in the meteorological data file used in the simulation. The pattern and intensity of rainfall affects the build-up and wash-off of fecal coliform bacteria from the land into the streams, as well as the dilution potential of the stream. Precipitation data from a weather station in close proximity to a watershed was used in the simulations and are presented in Appendix A.

7.3 Model Calibration

Calibration of the watershed model included both hydrology and water quality components. The hydrology calibration was performed first and involved adjustment of the model parameters used to represent the hydrologic cycle until acceptable agreement was achieved between simulated flows and historic stream flow data from a USGS stream gaging station in the watershed for the same period of time. Model parameters adjusted include: evapotranspiration, infiltration, upper and lower zone storage, groundwater storage, recession, losses to the deep groundwater system, and interflow discharge. Hydrology calibrations are presented in Appendix A along with USGS gages used for the flow calibrations. Calibrated models were then subjected to model validation to ensure that generated model streamflows for each of the impaired segments were acceptable.

The model was also calibrated for water quality. Appropriate model parameters were adjusted to obtain acceptable agreement between simulated instream fecal coliform concentrations and observed data collected at the sampling stations indicated in Table 4. Water quality calibrations are presented in Appendix B.

8.0 DEVELOPMENT OF TOTAL MAXIMUM DAILY LOAD

The TMDL process quantifies the amount of a pollutant that can be assimilated in a waterbody, identifies sources of the pollutant, and recommends regulatory or other actions to be taken to achieve compliance with applicable water quality standards based on the relationship between pollution sources and in-stream water quality conditions. A TMDL can be expressed as the sum of all point source loads (WLAs), nonpoint source loads (LAs), and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$\text{TMDL} = \Sigma\ \text{WLAs} + \Sigma\ \text{LAs} + \text{MOS}$$

The objective of a TMDL is to allocate loads among known pollutant sources throughout a watershed so that appropriate control measures can be implemented and water quality standards achieved. 40 CFR

§130.2 (i) states that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or other appropriate measure. For fecal coliform bacteria, the TMDLs are expressed as counts per 30 days. The TMDL represents the maximum load that can occur over a 30-day period while maintaining water quality standards.

8.1 Critical Conditions

The critical condition for nonpoint source fecal coliform loading is an extended dry period followed by a rainfall runoff event. During the dry weather period, fecal coliform bacteria builds up on the land surface, and is washed off by rainfall. The critical condition for point source loading occurs during periods of low stream flow when dilution is minimized. Both conditions are simulated in the water quality model. For the South River TMDLs, the critical period occurs when the CSOs are discharging to Intrenchment Creek and North Branch South River.

A definitive time period was used to simulate a continuous 30-day geometric mean concentration to compare to the target. For TMDLs in the Upper Ocmulgee Basin, this time period is six years as this is the time period when water quality data from CSOs were available. This time period covers a range of hydrological conditions that included both low and high stream flows.

The simulated 30-day geometric mean concentrations for existing conditions are presented in Appendix C. From these figures, critical conditions can be determined. The 30-day critical period in the model is the period preceding the largest simulated violation of the geometric mean standard (EPA, 1991). For the South River TMDLs, the critical period coincides with the ones chosen by EPD in the development of the Intrenchment Creek and North Branch South River TMDLs. During periods where the model predicted extremely low stream flows, the model often became unstable and exhibited extreme positive or negative spikes. These portions of the simulation were excluded from consideration of the critical period. Meeting water quality standards during the critical period ensures that water quality standards can be achieved throughout the reviewed time period. The critical period used in development of the TMDLs is given in Table 8.

8.2 Existing Conditions

The existing fecal coliform load for each of the 303(d) listed waterbodies in the Upper Ocmulgee River Basin was determined in the following manner:

- The calibrated model, corresponding to the portion of the Upper Ocmulgee River Basin that is upstream of the pour point of the listed waterbody segment was run for a time period that included the critical condition. This critical time period is provided for each listed segment in Table 8.

- The existing fecal coliform load for each listed segment is represented as the sum of the NPDES permitted fecal coliform load from all point discharges (at design limits), the daily discharge load of other modeled direct sources (e.g., other direct sources such as animal access to streams, illicit discharges of fecal coliform bacteria, failing septic systems, or leaking sewer collection lines), and the daily fecal coliform load indirectly going to surface waters from all land uses (e.g., surface runoff), over the 30 day critical period.

Model results indicate that nonpoint sources related to urban and agricultural land uses have the greatest impact on the fecal coliform bacteria loading in the Upper Ocmulgee River Basin. Direct inputs of fecal coliform bacteria from “other sources” (i.e., animal access to streams, illicit discharges of fecal coliform bacteria, failing septic systems, and leaking sewer collection lines) are also shown to increase bacteria loading in the watershed. Reductions in these loading rates reduce the in-stream fecal coliform bacteria levels. Nonpoint source loading rates representing existing conditions during the critical period are shown in Table 8.

In general, point source loads from NPDES facilities, with the exception of CSOs, do not significantly contribute to the impairment of the listed stream segments since discharges from these facilities are required to be treated to levels corresponding to instream water quality criteria. EPD developed TMDLs for Intrenchment Creek and the North Branch of South River, both tributaries of the South River, and indicate CSOs as the primary contributors to water quality impairment. Based on EPD’s analysis, CSOs are considered a contributor to impairment in the South River. Table 6 provides point source loads from NPDES facilities based on DMRs (when available), and loads based on permitted facility flows and limits. As shown in this table, most facilities for which data are available have existing (i.e., based on DMR reporting) loads that are significantly lower than the maximum load at the permit limits.

8.3 Margin of Safety (MOS)

There are two methods for incorporating a MOS in the analysis: a) implicitly incorporate the MOS using conservative model assumptions to develop allocations; or b) explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations. Both an explicit and an implicit MOS were incorporated in these TMDLs. Implicit MOS include conservative modeling assumptions and a continuous simulation that incorporates a range of meteorological events. Conservative modeling assumptions used include: septic systems discharging directly into the streams; development of the TMDL using loads based on the design flow and fecal coliform permit limits of NPDES facilities; and all land areas considered to be connected directly to streams. An explicit MOS was included in the TMDLs by reducing the load allocation by 10 percent. In several of the TMDLs, a MOS was also included in the instream concentration by reducing the maximum geometric mean concentration to levels below the target. For example, in the Yellow River TMDL, the simulated peak concentration for the allocation scenario was reduced to about 140 counts/100mL, or 60 counts below the criteria of 200 counts/100mL. This represents a MOS of about 30 percent.

8.4 Determination of TMDL, WLA, and LA

The TMDL is the total amount of pollutant that can be assimilated by a water body while maintaining water quality standards. Fecal coliform bacteria TMDLs are expressed as counts per 30-day period as the water quality standard is expressed in terms of the 30-day geometric mean. The TMDL, therefore, represents the maximum fecal coliform bacteria load that can be assimilated by a stream during the critical 30-day period while maintaining the fecal coliform bacteria water quality standard of 200 counts / 100 ml. As previously stated, the TMDL is calculated using the equation:

$$\text{TMDL} = \Sigma\ \text{WLAs} + \Sigma\ \text{LAs} + \text{MOS}$$

With MOS equal to10 percent of the LA value, the TMDL, $\sum$WLA, and $\sum$LA were determined according to the following procedure:

- The calibrated model, corresponding to the portion of the watershed that is upstream of the pour point of the listed waterbody segment was run for a time period that included the critical condition as specified in Table 8.

- Existing NPDES permitted facilities and any known future facility discharges were assumed to discharge at design flows and the fecal coliform permit limit of 200-counts/100 ml.

- Fecal coliform land loading variables and the magnitude of loading from sources modeled as "other direct sources" were adjusted within a reasonable range of known values until the resulting fecal coliform concentration at the pour point of the listed water body segment was less than or equal to 200 counts/100ml. In several of the models, the simulated concentration resulting from the allocation scenario was below the target by at least 10 percent. The difference in the simulated and target concentrations represents an additional MOS in the TMDL.

- The $\sum$WLA is the load associated with the daily discharge loads of all modeled NPDES permitted facilities summed over the 30-day critical period. The discharge load for each facility represents the design flow at a fecal coliform concentration of 200-counts/100 ml (permit limit).

- The $\sum$LA is the daily fecal coliform load indirectly going to surface waters from all modeled land use areas as a result of buildup/washoff processes plus the daily discharge load sources modeled as "other direct sources" and the result summed over the 30-day critical period. The resultant load was reduced by 10 percent and represents the MOS.

The TMDL components for the listed water bodies are summarized in Table 9.

8.4.1 Waste Load Allocations

There are numerous NPDES permitted facilities that discharge fecal coliform bacteria in the Upper Ocmulgee River Basin. In the TMDL, the WLA assigned to each impaired segment is the sum of the load from all NPDES facilities in the drainage basin of the impaired segment. For the South River TMDL, discharges from the CSO facilities were reduced to loads consistent with the TMDLs developed by EPD for Intrenchment Creek and North Branch South River. Future facility located on 303(d) listed waters should discharge wastewater at concentrations that do not cause or contribute to water quality impairment of these streams.

8.4.2 Load Allocations

There are two modes of transport for nonpoint source fecal coliform bacteria loading in the model. First, loading from failing septic systems, animals in the stream, and leaking sewer system collection lines are modeled as "other direct sources" to the stream and are independent of precipitation. The second mode involves loading resulting from fecal coliform accumulation on land surfaces and wash-off during storm events. Fecal coliform applied to land is subject to a die-off rate and an absorption rate before it is transported to the stream.

Model results were analyzed to determine which sources of fecal coliform have the greatest impact on the fecal coliform bacteria loadings in Upper Ocmulgee River Basin. In general, nonpoint source runoff contributes the greatest fecal coliform load to the streams. Reductions in both urban and agricultural loads to the stream as well as reductions in direct sources to the stream (i.e., animal access to streams and leaking septic systems) are shown to improve water quality conditions. The percent reductions required from nonpoint source loads to the impaired streams are shown in Table 9.

Water quality impairment in Lake Jackson is due primarily to the load from the upstream watersheds. Water quality conditions should improve when the load from the upstream watersheds is reduced. An analysis of the data collected at the Lake Jackson Dam pool illustrates high fecal coliform concentrations during the late spring and early summer following storm events. It is believed that these elevated values are caused by flows "short-circuiting" (flows moving directly through the reservoir in the top layer) through the reservoir. By bringing the upstream watersheds into compliance, water quality standards should be achieved in the lake. Best management practices should be employed in the urban areas around the lake to ensure that fecal coliform bacteria levels remain below the water quality standard.

Best management practices (BMPs) that could be used to implement this TMDL include controlling pollution from agriculture and urban runoff, identification and elimination of illicit discharges and other unknown "direct sources" of fecal coliform bacteria to the streams, and repair of leaking sewer collection lines and failing septic systems. The South River is impacted by CSOs. For this stream to meet water quality standards, the load from CSOs would need to meet water quality criteria at end of pipe. Compliance with the consent decree between the City of Atlanta and EPA should result in obtainment of water quality standards. Loading from agricultural sources may be minimized by adoption of NRCS resource management practices. NRCS practices include measures such as covering manure stacks exposed to the environment; reducing animal access to streams; and applying manure to agricultural lands at agronomic rates. Measures which can reduce urban contributions include: repair and renovation of leaking sewer collection systems; reduction of sewer overflows and surcharges by use of separate conduit systems for domestic wastewater and stormwater; encouragement of households and businesses to connect to public sewer systems and reduce the population using septic systems.

8.4.3 Seasonal Variation

Seasonal variation was incorporated in the continuous simulation water quality model by using varying monthly loading rates, daily meteorological data, and a long-term time period.

9.0 RECOMMENDATIONS

The TMDL analysis was performed using the best data available to specify WLAs and LAs that will meet the water quality criteria for fecal coliform in the Upper Ocmulgee River Basin so as to support the use classification specified for each of the listed segments in Table 3. The following recommendations and strategies are targeted toward source identification, collection of data to support additional modeling and evaluation, and subsequent reduction in sources that are causing impairment of water quality.

9.1 Point Source Facilities

All discharges from point source facilities are required to be in compliance with the conditions of their NPDES permit at all times. All future facilities with the potential to discharge fecal coliform should be given limits that do not cause or contribute to water quality impairment.

9.2 Urban Sources of Fecal Coliform Loading

Urban sources of fecal coliform can best be addressed using a strategy which involves public participation and intergovernmental coordination to reduce the discharge of pollutants to the maximum extent practicable using management practices, control techniques, public education, and other appropriate methods and provisions. The following activities and programs conducted by cities, counties, and state agencies are recommended:

- Monitoring programs to identify the types and extent of fecal coliform water quality problems, relative degradation or improvement over time, areas of concern, and source identification;

- Requirements that all new and replacement sanitary sewage systems are designed to minimize discharges from the system into storm sewer systems;

- Mechanisms for reporting and correcting illicit connections, breaks, surcharges, and general sanitary sewer system problems;

- Sustained compliance with NPDES permit discharge requirements.

9.3 Agricultural Sources of Fecal Coliform Loading

The Georgia Environmental Protection Division (EPD) should coordinate with the Georgia Soil and Water Conservation Commission, and the Natural Resources Conservation Service (NRCS) to address issues concerning fecal coliform loading from agricultural lands in the Upper Ocmulgee River Basin. It is recommended that information (such as livestock populations by subwatershed, animal access to streams, manure application practices, etc.) be evaluated periodically so that watershed models can be updated to reflect current conditions. It is further recommended that BMPs be utilized to reduce the amount of fecal coliform bacteria transported to surface waters from agricultural sources to the maximum extent practicable.

9.4 Stream Monitoring

Further monitoring of the fecal coliform concentrations at current and additional water quality monitoring stations in the watershed is needed to better characterize sources of fecal coliform bacteria and document future reduction of loading. Georgia's watershed management approach specifies a five-year cycle for planning and assessment. Watersheds will be examined (or re-examined) as appropriate, on a rotating basis.

9.5 Future Efforts

This TMDL represents the first phase of a long-term process to reduce fecal coliform loading to meet water quality standards in the Upper Ocmulgee River Basin. Implementation strategies will be reviewed and the TMDLs will be refined as necessary in the next phase (next five-year cycle). The phased approach will support progress toward water quality standards attainment in the future. In accordance with USEPA TMDL guidance, these TMDLs may be revised based on results of future monitoring and source characterization data efforts.

10.0 Public Participation

A sixty-day public comment period was provided for this TMDL document. During the comment period, the availability of the TMDLs was public noticed, the TMDLs were posted on EPA's website, and copy of the TMDLs were provided, as requested, to the public for their comments. The response to comments received on the TMDLs can be found in the document entitled "*Responsiveness Summary Concerning EPA's August 30, 2001 Pubic Notice Proposing Fecal Coliform TMDLs For Waters in the State of Georgia*" (EPA, 2002).

11.0 Implementation

EPD has coordinated with EPA to prepare this Initial TMDL Implementation Plan for this TMDL. EPD has also established a plan and schedule for development of a more comprehensive implementation plan after this TMDL is established. EPD and EPA have executed a Memorandum of Understanding that documents the schedule for developing the more comprehensive plans. This Initial TMDL Implementation Plan includes a list of best management practices and provides for an initial implementation demonstration project to address one of the major sources of pollutants identified in this TMDL while State and/or local agencies work with local stakeholders to develop a revised TMDL implementation plan. It also includes a process whereby EPD and/or Regional Development Centers (RDCs) or other EPD contractors (hereinafter, "EPD Contractors") will develop expanded plans (hereinafter, "Revised TMDL Implementation Plans").

This Initial TMDL Implementation Plan, written by EPD and for which EPD and/or the EPD Contractor are responsible, contains the following elements.

1. EPA has identified a number of management strategies for the control of nonpoint sources of pollutants, representing some best management practices. The "Management Measure Selector Table" shown in Table 10 identifies these management strategies by source category and pollutant. Nonpoint sources are the primary cause of excessive pollutant loading in most cases. Any wasteload allocations in this TMDL will be implemented in the form of water-quality based effluent limitations in NPDES permits issued under CWA Section 402. See 40 C.F.R. § 122.44(d)(1)(vii)(B). NPDES permit discharges are a secondary source of excessive pollutant loading, where they are a factor, in most cases.

2. EPD and the EPD Contractor will select and implement one or more best management practice (BMP) demonstration projects for each River Basin. The purpose of the demonstration projects will be to evaluate by River Basin and pollutant parameter the site-specific effectiveness of one or more of the BMPs chosen. EPD intends that the BMP demonstration project be completed before the Revised TMDL Implementation Plan is issued. The BMP demonstration project will address the major category of contribution of the pollutant(s) of concern for the respective River Basin as identified in the TMDLs of the watersheds in the River Basin. The demonstration project need not be of a large scale, and may consist of one or more measures from the Table or equivalent BMP measures proposed by the EPD Contractor and approved by EPD. Other such measures may include those found in EPA's "Best Management Practices Handbook", the "NRCS National Handbook of Conservation Practices, or any similar reference, or measures that the volunteers, etc., devise that EPD approves. If for any reason the EPD Contractor does not complete the BMP demonstration project, EPD will take responsibility for doing so.

3. As part of the Initial TMDL Implementation Plan the EPD brochure entitled "Watershed Wisdom -- Georgia's TMDL Program" will be distributed by EPD to the EPD Contractor for use with appropriate stakeholders for this TMDL, and a copy of the video of that same title will be provided to the EPD Contractor for its use in making presentations to appropriate stakeholders, on TMDL Implementation plan development.

4. If for any reason an EPD Contractor does not complete one or more elements of a Revised TMDL Implementation Plan, EPD will be responsible for getting that (those) element(s) completed, either directly or through another contractor.

5. The deadline for development of a Revised TMDL Implementation Plan is the end of August 2003.

6. The EPD Contractor helping to develop the Revised TMDL Implementation Plan, in coordination with EPD, will work on the following tasks involved in converting the Initial

TMDL Implementation Plan to a Revised TMDL Implementation Plan:

A. Generally characterize the watershed;
B. Identify stakeholders;
C. Verify the present problem to the extent feasible and appropriate, (e.g., local monitoring);
D. Identify probable sources of pollutant(s);
E. For the purpose of assisting in the implementation of the load allocations of this TMDL, identify potential regulatory or voluntary actions to control pollutant(s) from the relevant nonpoint sources;
F. Determine measurable milestones of progress;
G. Develop monitoring plan, taking into account available resources, to measure effectiveness; and
H. Complete and submit to EPD the Revised TMDL Implementation Plan.

7. The public will be provided an opportunity to participate in the development of the Revised TMDL Implementation Plan and to comment on it before it is finalized.

8. The Revised TMDL Implementation Plan will supersede this Initial TMDL Implementation Plan when the Revised TMDL Implementation Plan is approved by EPD.

Table 2 Land Use Distribution for 303(d) Listed Streams in the Upper Ocmulgee River Basin (source: MRLC, 1993)

Stream/Segment	Land Use Categories - in units of acres (percent)																
	Bare Rock/Sand/Clay	Deciduous Forest	Emergent Herbaceous Wetlands	Evergreen Forest	High Intensity Commercial/Industrial/Transportation	Low Intensity Commercial/Industrial/Transportation	High Intensity Residential	Low Intensity Residential	Mixed Forest	Open Water	Other Grasses Urban/Recreational	Pasture/Hay	Quarries/Strip Mines/Gravel Pits	Row Crops	Transitional	Woody Wetlands	Unclassified
Alcovy River (Cedar Creek to Bay Creek)	2 (0.0)	14430 (36.9)	17 (0.0)	5920 (15.1)	995 (2.6)	0 (0.0)	254 (0.7)	934 (2.4)	9056 (23.2)	225 (0.6)	658 (1.7)	4322 (11.1)	0 (0.0)	1306 (3.3)	173 (0.4)	804 (2.1)	0 (0.0)
Almand Branch (Tanyard Branch to Snapping Shoals)	0 (0.0)	1046 (17.7)	20 (0.3)	880 (14.9)	610 (10.3)	0 (0.0)	153 (2.6)	832 (14.1)	949 (16.0)	35 (0.6)	286 (4.8)	375 (6.3)	0 (0.0)	309 (5.2)	4 (0.07)	421 (7.1)	0 (0.0)
Beaver Ruin Creek (Gwinnett County)	0 (0.0)	914 (14.9)	89 (1.5)	441 (7.2)	1007 (16.4)	0 (0.0)	792 (12.9)	1627 (26.6)	740 (12.1)	98 (1.6)	192 (3.1)	0 (0.0)	0 (0.0)	0 (0.0)	159 (2.6)	70 (1.1)	0 (0.0)
Big Cotton Indian Creek (Panther Creek to Brush Creek)	12 (0.0)	19675 (24.4)	102 (0.1)	14501 (18.0)	3917 (4.9)	0 (0.0)	1339 (1.7)	7779 (9.6)	16253 (20.1)	1505 (1.9)	1486 (1.8)	7539 (9.3)	287 (0.4)	3822 (4.7)	229 (0.3)	2361 (2.9)	0 (0.0)

Stream/Segment	Land Use Categories - in units of acres (percent)																
	Bare Rock/Sand/Clay	Deciduous Forest	Emergent Herbaceous Wetlands	Evergreen Forest	High Intensity Commercial/Industrial/Transportation	Low Intensity Commercial/Industrial/Transportation	High Intensity Residential	Low Intensity Residential	Mixed Forest	Open Water	Other Grasses Urban/Recreational	Pasture/Hay	Quarries/Strip Mines/Gravel Pits	Row Crops	Transitional	Woody Wetlands	Unclassified
Big Flat Creek (Headwaters to Flat Creek)	0 (0.0)	3968 (32.5)	62 (0.5)	1240 (10.2)	140 (1.2)	0 (0.0)	51 (0.4)	188 (1.5)	1907 (15.6)	34 (0.3)	101 (0.8)	3155 (25.8)	0 (0.0)	938 (7.7)	66 (0.5)	367 (3.0)	0 (0.0)
Big Haynes Creek (Brushy Creek to Little Panther Creek)	0 (0.0)	4440 (20.5)	3 (0.0)	4328 (20.0)	297 (1.4)	0 (0.0)	139 (0.6)	1030 (4.8)	5485 (25.3)	210 (1.0)	434 (2.0)	3946 (18.2)	0 (0.0)	1320 (6.1)	1 (0.0)	40 (0.2)	0 (0.0)
Big Haynes Creek (Headwaters to Brushy Creek)	0 (0.0)	4042 (19.7)	3 (0.0)	4123 (20.0)	292 (1.4)	0 (0.0)	139 (0.7)	1029 (5.0)	5154 (25.1)	199 (1.0)	428 (2.1)	3866 (18.8)	0 (0.0)	1256 (6.1)	1 (0.0)	40 (0.2)	0 (0.0)
Big Haynes Creek (Little Haynes Creek to Yellow River)	1 (0.0)	14429 (27.4)	26 (0.1)	10708 (20.3)	560 (1.1)	0 (0.0)	169 (0.3)	1178 (2.2)	12796 (24.3)	453 (0.9)	606 (1.2)	7568 (14.4)	0 (0.0)	2973 (5.7)	39 (0.1)	1154 (2.2)	0 (0.0)
Big Sandy Creek (Aboothlacoosta Creek to Ocmulgee River)	0 (0.0)	13738 (37.9)	67 (0.2)	8793 (24.3)	137 (0.4)	0 (0.0)	69 (0.2)	333 (0.9)	6822 (18.8)	167 (0.5)	146 (0.4)	2744 (7.6)	0 (0.0)	847 (2.3)	902 (2.5)	1447 (4.0)	0 (0.0)

Stream/Segment	Land Use Categories - in units of acres (percent)																
	Bare Rock/Sand/Clay	Deciduous Forest	Emergent Herbaceous Wetlands	Evergreen Forest	High Intensity Commercial/Industrial/Transportation	Low Intensity Commercial/Industrial/Transportation	High Intensity Residential	Low Intensity Residential	Mixed Forest	Open Water	Other Grasses Urban/Recreational	Pasture/Hay	Quarries/Strip Mines/Gravel Pits	Row Crops	Transitional	Woody Wetlands	Unclassified
Bromolow Creek (Headwaters to Beaver Ruin Creek)	0 (0.0)	921 (13.7)	75 (1.1)	770 (11.4)	1107 (16.4)	0 (0.0)	518 (7.7)	1684 (25.0)	1073 (15.9)	13 (0.2)	354 (5.3)	1 (0.0)	0 (0.0)	0 (0.0)	32 (0.5)	201 (3.0)	0 (0.0)
Cabin Creek (Headwaters Griffin to Towaliga River)	0 (0.0)	5908 (27.3)	1 (0.0)	3325 (15.4)	314 (1.4)	0 (0.0)	176 (0.8)	1123 (5.2)	5238 (24.2)	150 (0.7)	386 (1.8)	3766 (17.4)	0 (0.0)	1097 (5.1)	10 (0.0)	159 (0.7)	0 (0.0)
Camp Creek (Headwaters to Jackson Creek)	0 (0.0)	738 (15.0)	0 (0.0)	826 (16.8)	370 (7.5)	0 (0.0)	179 (3.6)	1103 (22.4)	1243 (25.3)	8 (0.2)	191 (3.9)	30 (0.6)	0 (0.0)	111 (2.3)	120 (2.4)	0 (0.0)	0 (0.0)
Cedar Creek (Headwaters to Alcovy River)	0 (0.0)	1889 (48.4)	0 (0.0)	493 (12.6)	4 (0.1)	0 (0.0)	0 (0.0)	1 (0.0)	586 (15.0)	2 (0.1)	0 (0.0)	667 (17.1)	0 (0.0)	191 (4.9)	14 (0.4)	58 (1.5)	0 (0.0)
Falling Creek (Little Falling Creek to Ocmulgee River)	24 (0.0)	24012 (34.8)	8 (0.0)	32817 (47.6)	11 (0.0)	0 (0.0)	0 (0.0)	41 (0.1)	9113 (13.2)	157 (0.2)	13 (0.0)	703 (1.0)	49 (0.1)	551 (0.8)	1061 (1.5)	396 (0.6)	0 (0.0)

Stream/Segment	Land Use Categories - in units of acres (percent)																
	Bare Rock/Sand/Clay	Deciduous Forest	Emergent Herbaceous Wetlands	Evergreen Forest	High Intensity Commercial/Industrial/Transportation	Low Intensity Commercial/Industrial/Transportation	High Intensity Residential	Low Intensity Residential	Mixed Forest	Open Water	Other Grasses Urban/Recreational	Pasture/Hay	Quarries/Strip Mines/Gravel Pits	Row Crops	Transitional	Woody Wetlands	Unclassified
Hopkins Creek (Headwaters to Alcovy River)	0 (0.0)	1398 (45.2)	0 (0.0)	425 (13.7)	68 (2.2)	0 (0.0)	23 (0.7)	102 (3.3)	561 (18.1)	4 (0.1)	30 (1.0)	345 (11.1)	0 (0.0)	94 (3.0)	45 (1.5)	0 (0.0)	0 (0.0)
Jacks Creek (Headwaters to Yellow River)	0 (0.0)	549 (16.6)	0 (0.0)	399 (12.1)	98 (2.3)	0 (0.0)	200 (6.1)	1076 (32.6)	709 (21.5)	2 (0.1)	267 (8.1)	3 (0.1)	0 (0.0)	2 (0.1)	1 (0.0)	0 (0.0)	0 (0.0)
Jackson Creek (Gwinnett County)	0 (0.0)	1936 (14.1)	0 (0.0)	2138 (15.5)	670 (4.9)	0 (0.0)	943 (6.9)	4155 (30.2)	3080 (22.4)	35 (0.3)	461 (3.4)	49 (0.4)	0 (0.0)	133 (1.0)	157 (1.1)	0 (0.0)	0 (0.0)
Little Haynes Creek (Hwy 20 to Big Haynes Creek)	0 (0.0)	5666 (33.3)	9 (0.1)	3092 (18.2)	213 (1.3)	0 (0.0)	29 (0.2)	129 (0.8)	4032 (23.7)	69 (0.4)	119 (0.7)	2284 (13.4)	0 (0.0)	937 (5.5)	8 (0.1)	411 (2.4)	0 (0.0)

Stream/Segment	Land Use Categories - in units of acres (percent)																
	Bare Rock/Sand/Clay	Deciduous Forest	Emergent Herbaceous Wetlands	Evergreen Forest	High Intensity Commercial/Industrial/Transportation	Low Intensity Commercial/Industrial/Transportation	High Intensity Residential	Low Intensity Residential	Mixed Forest	Open Water	Other Grasses Urban/Recreational	Pasture/Hay	Quarries/Strip Mines/Gravel Pits	Row Crops	Transitional	Woody Wetlands	Unclassified
Little Stone Mountain Creek (Headwaters to Stone Mountain Lake)	0 (0.0)	352 (17.7)	0 (0.0)	489 (24.6)	32 (1.6)	0 (0.0)	10 (0.5)	363 (18.2)	690 (34.6)	6 (0.3)	40 (2.0)	3 (0.2)	0 (0.0)	7 (0.4)	0 (0.0)	0 (0.0)	0 (0.0)
Little Suwanee Creek (Tributary to Yellow River)	0 (0.0)	1611 (29.3)	33 (0.6)	681 (12.4)	310 (5.6)	0 (0.0)	79 (1.4)	649 (11.8)	1308 (23.8)	91 (1.7)	207 (3.8)	99 (1.8)	0 (0.0)	68 (1.2)	1 (0.0)	357 (6.5)	0 (0.0)
No Business Creek (Headwaters to Norris Lake)	0 (0.0)	2410 (26.1)	0 (0.0)	1620 (17.5)	248 (2.7)	0 (0.0)	187 (2.0)	929 (10.1)	2348 (25.4)	112 (1.2)	265 (2.9)	748 (8.1)	0 (0.0)	314 (3.4)	53 (0.6)	0 (0.0)	0 (0.0)
Ocmulgee River (Tobesofkee Cr. to Walnut Cr.)	0 (0.0)	13738 (37.9)	67 (0.2)	8793 (24.3)	137 (0.4)	0 (0.0)	69 (0.2)	333 (0.9)	6822 (18.2)	167 (0.5)	146 (0.4)	2744 (7.6)	0 (0.0)	847 (2.3)	902 (2.5)	1447 (4.0)	0 (0.0)
Pew Creek (Gwinnett County)	0 (0.0)	3823 (19.8)	16 (0.1)	2663 (13.8)	1377 (7.2)	0 (0.0)	779 (4.0)	4487 (23.3)	4063 (21.1)	111 (0.6)	1301 (6.8)	326 (1.7)	0 (0.0)	72 (0.4)	161 (0.8)	87 (0.5)	0 (0.0)

Stream/Segment	Land Use Categories - in units of acres (percent)																
	Bare Rock/Sand/Clay	Deciduous Forest	Emergent Herbaceous Wetlands	Evergreen Forest	High Intensity Commercial/Industrial/Transportation	Low Intensity Commercial/Industrial/Transportation	High Intensity Residential	Low Intensity Residential	Mixed Forest	Open Water	Other Grasses Urban/Recreational	Pasture/Hay	Quarries/Strip Mines/Gravel Pits	Row Crops	Transitional	Woody Wetlands	Unclassified
Rocky Creek (1 mile u/s Rocky Creek Road to Tobesofkee Creek)	193 (0.6)	6900 (21.3)	17 (0.1)	5323 (16.4)	2280 (7.0)	0 (0.0)	2115 (6.5)	4687 (14.4)	5026 (15.5)	348 (1.1)	553 (1.7)	843 (2.6)	143 (0.4)	1978 (6.1)	1163 (3.6)	871 (2.7)	0 (0.0)
Shetley Creek (Headwaters to Bromolow Creek)	0 (0.0)	125 (15.2)	0 (0.0)	76 (9.2)	86 (10.5)	0 (0.0)	38 (4.6)	288 (35.0)	158 (19.2)	0 (0.0)	51 (6.2)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	0 (0.0)	0 (0.0)
Shoal Creek (Headwaters to Alcovy River)	0 (0.0)	1698 (31.8)	0 (0.0)	756 (14.2)	201 (3.8)	0 (0.0)	184 (3.5)	571 (10.7)	1284 (24.1)	27 (0.5)	155 (2.9)	381 (7.1)	0 (0.0)	77 (1.4)	0 (0.0)	0 (0.0)	0 (0.0)
Snapping Shoals Creek (Almand Branch to South River)	0 (0.0)	6726 (26.7)	36 (0.1)	4216 (16.7)	1326 (5.3)	0 (0.0)	413 (1.6)	1884 (7.5)	3809 (15.1)	135 (0.5)	662 (2.6)	3012 (11.9)	0 (0.0)	1742 (6.9)	126 (0.5)	1130 (4.5)	0 (0.0)
South River (Atlanta to Flakes Mill Road)	3 (0.0)	11467 (17.9)	0 (0.0)	6838 (10.7)	7902 (12.4)	0 (0.0)	5025 (7.9)	20335 (31.8)	8765 (13.7)	121 (0.2)	2337 (3.7)	204 (0.3)	0 (0.0)	348 (0.5)	563 (0.9)	0 (0.0)	0 (0.0)

Stream/Segment	Land Use Categories - in units of acres (percent)																	
	Bare Rock/Sand/Clay	Deciduous Forest	Emergent Herbaceous Wetlands	Evergreen Forest	High Intensity Commercial/Industrial/Transportation	Low Intensity Commercial/Industrial/Transportation	High Intensity Residential	Low Intensity Residential	Mixed Forest	Open Water	Other Grasses Urban/Recreational	Pasture/Hay	Quarries/Strip Mines/Gravel Pits	Row Crops	Transitional	Woody Wetlands	Unclassified
South River (Flakes Mill Road to Pole Bridge Creek)	2 (0.0)	8204 (21.1)	10 (0.0)	6470 (16.6)	2094 (5.4)	0 (0.0)	1818 (4.7)	10993 (28.2)	6741 (17.3)	183 (0.5)	847 (2.2)	484 (1.2)	0 (0.0)	346 (0.9)	464 (1.2)	284 (0.7)	0 (0.0)
South River (Hwy 20 to Snapping Shoals Creek)	14 (0.0)	54403 (28.6)	223 (0.1)	34254 (18.0)	6117 (3.2)	0 (0.0)	1878 (1.0)	10583 (5.6)	35744 (18.8)	2620 (1.4)	2598 (1.4)	24057 (12.6)	0 (0.0)	12310 (6.5)	509 (0.3)	4701 (2.5)	0 (0.0)
South River (Pole Bridge Creek to Hwy 20)	0 (0.0)	15429 (27.4)	3 (0.0)	12476 (22.1)	1087 (1.9)	0 (0.0)	608 (1.1)	4523 (8.0)	12770 (22.7)	470 (0.8)	829 (1.5)	4777 (8.5)	602 (1.1)	2151 (3.8)	397 (0.7)	246 (0.4)	0 (0.0)
South River (Snapping Shoals to Jackson Lake)	0 (0.0)	13686 (45.4)	15 (0.1)	5811 (19.3)	123 (0.4)	0 (0.0)	9 (0.0)	136 (0.5)	5015 (16.6)	698 (2.3)	36 (0.1)	3102 (10.3)	0 (0.0)	1284 (4.3)	28 (0.1)	201 (0.7)	0 (0.0)
Stone Mountain Creek (Headwaters to Stone Mountain Lake)	0 (0.0)	582 (22.4)	0 (0.0)	457 (17.6)	363 (14.0)	0 (0.0)	81 (3.1)	334 (12.9)	714 (27.5)	5 (0.2)	45 (1.7)	0 (0.0)	0 (0.0)	0 (0.0)	14 (0.5)	0 (0.0)	0 (0.0)

Stream/Segment	Land Use Categories - in units of acres (percent)																
	Bare Rock/Sand/Clay	Deciduous Forest	Emergent Herbaceous Wetlands	Evergreen Forest	High Intensity Commercial/Industrial/Transportation	Low Intensity Commercial/Industrial/Transportation	High Intensity Residential	Low Intensity Residential	Mixed Forest	Open Water	Other Grasses Urban/Recreational	Pasture/Hay	Quarries/Strip Mines/Gravel Pits	Row Crops	Transitional	Woody Wetlands	Unclassified
Sweetwater Creek (Lee Daniel Creek to Yellow River)	0 (0.0)	5876 (18.7)	188 (0.6)	4371 (13.9)	3420 (10.9)	0 (0.0)	1872 (6.0)	6162 (19.6)	6192 (19.7)	258 (0.8)	1146 (3.7)	827 (2.6)	0 (0.0)	272 (0.9)	356 (1.1)	496 (1.6)	0 (0.0)
Swift Creek (Headwaters to Yellow R)	0 (0.0)	1320 (26.0)	0 (0.0)	1192 (23.5)	111 (2.2)	0 (0.0)	11 (0.2)	188 (3.7)	1213 (23.4)	95 (1.9)	48 (1.0)	108 (2.1)	572 (11.3)	188 (3.7)	31 (0.6)	0 (0.0)	0 (0.0)
Tobesofkee Cr (3 segments) (Cole Creek to Rocky Creek)	168 (0.1)	45827 (33.3)	88 (0.1)	28721 (20.9)	717 (0.5)	0 (0.0)	717 (0.5)	3401 (2.5)	20372 (14.8)	1967 (1.4)	593 (0.4)	15752 (11.4)	326 (0.2)	8642 (6.3)	3099 (2.3)	6799 (4.9)	0 (0.0)
Town Branch (D/S Jackson South WPCP to Aboothlacoosta Creek)	0 (0.0)	852 (36.5)	0 (0.0	483 (20.7)	73 (3.1)	0 (0.0)	40 (1.7)	157 (6.7)	536 (23.0)	3 (0.1)	47 (2.0)	114 (4.9)	0 (0.0	22 (1.0)	0 (0.0	3 (0.1)	0 (0.0)

Stream/Segment	Land Use Categories - in units of acres (percent)																
	Bare Rock/Sand/Clay	Deciduous Forest	Emergent Herbaceous Wetlands	Evergreen Forest	High Intensity Commercial/Industrial/Transportation	Low Intensity Commercial/Industrial/Transportation	High Intensity Residential	Low Intensity Residential	Mixed Forest	Open Water	Other Grasses Urban/Recreational	Pasture/Hay	Quarries/Strip Mines/Gravel Pits	Row Crops	Transitional	Woody Wetlands	Unclassified
Turkey Creek (Headwaters to Yellow River)	0 (0.0)	262 (15.6)	0 (0.0)	298 (17.7)	30 (1.8)	0 (0.0)	75 (4.5)	505 (30.0)	365 (21.7)	2 (0.1)	81 (4.8)	36 (2.1)	0 (0.0)	15 (0.9)	14 (0.8)	0 (0.0)	0 (0.0)
Tussahaw Creek (Wolf Creek to Lake Jackson)	0 (0.0	13576 (28.5)	13 (0.0)	9792 (20.6)	142 (0.3)	0 (0.0)	35 (0.1)	157 (0.3)	9142 (19.2)	187 (0.4)	171 (0.4)	8298 (17.4)	58 (0.1)	3596 (7.5)	537 (1.1)	1881 (4.0)	0 (0.0)
Walnut Creek (Headwaters to Ocmulgee River)	164 (0.3)	18268 (30.7)	17 (0.0)	20275 (34.1)	506 (0.8)	0 (0.0)	459 (0.8)	2300 (3.9)	6984 (11.7)	379 (0.6)	111 (0.2)	2684 (4.5)	329 (0.6)	2348 (3.9)	4416 (7.4)	282 (0.5)	0 (0.0)
Watson Creek (Headwaters to Yellow River)	0 (0.0)	285 (11.2)	0 (0.0)	548 (21.6)	90 (3.6)	0 (0.0)	96 (3.8)	622 (24.5)	662 (26.1)	1 (0.0)	163 (6.4)	40 (1.6)	0 (0.0)	14 (0.6)	17 (0.7)	0 (0.0)	0 (0.0)

Stream/Segment	Land Use Categories - in units of acres (percent)																
	Bare Rock/Sand/Clay	Deciduous Forest	Emergent Herbaceous Wetlands	Evergreen Forest	High Intensity Commercial/Industrial/Transportation	Low Intensity Commercial/Industrial/Transportation	High Intensity Residential	Low Intensity Residential	Mixed Forest	Open Water	Other Grasses Urban/Recreational	Pasture/Hay	Quarries/Strip Mines/Gravel Pits	Row Crops	Transitional	Woody Wetlands	Unclassified
Wise Creek (Headwaters to Kinnard Creek)	3 (0.0)	4292 (38.8)	2 (0.0)	3023 (27.3)	3 (0.0)	0 (0.0)	0 (0.0)	2 (0.0)	2335 (21.1)	9 (0.1)	0 (0.0)	693 (6.3)	0 (0.0)	573 (5.2)	34 (0.3)	104 (0.9)	0 (0.0)
Yellow River (Big Haynes Creek to Jackson Lake)	4 (0.0)	15111 (24.9)	826 (0.2)	81472 (17.6)	21647 (4.7)	0 (0.0)	12124 (2.6)	58639 (12.7)	99123 (21.4)	4222 (0.9)	13726 (3.0)	31688 (6.9)	1886 (0.4)	13078 (2.8)	2666 (0.6)	6216 (1.3)	0 (0.0)
Yellow River (Hwy 124 to Big Haynes Creek)	2 (0.0)	37697 (22.7)	284 (0.2)	28328 (17.1)	9554 (5.8)	0 (0.0)	5555 (3.3)	28714 (17.3)	36553 (22.0)	1705 (1.0)	6104 (3.7)	4701 (2.8)	1224 (0.7)	2608 (1.6)	994 (0.6)	2081 (1.3)	0 (0.0)
Yellow River (Sweetwater Creek to Hwy 124)	0 (0.0)	20569 (19.8)	237 (0.2)	15442 (14.9)	7189 (6.9)	0 (0.0)	4780 (4.6)	23217 (22.4)	22349 (21.6)	654 (0.6)	4747 (4.6)	1950 (1.9)	0 (0.0)	794 (0.8)	725 (0.7)	999 (1.0)	0 (0.0)
Yellow Water Creek (1 mile d/s Stark Road)	0 (0.0)	7181 (36.2)	0 (0.0)	3182 (16.0)	157 (0.8)	0 (0.0)	60 (0.3)	349 (1.8)	3311 (16.7)	85 (0.4)	113 (0.6)	3850 (19.4)	0 (0.0)	1278 (6.4)	33 (0.2)	259 (1..3)	0 (0.0)

Stream/Segment	Land Use Categories - in units of acres (percent)																
	Bare Rock/Sand/Clay	Deciduous Forest	Emergent Herbaceous Wetlands	Evergreen Forest	High Intensity Commercial/Industrial/Transportation	Low Intensity Commercial/Industrial/Transportation	High Intensity Residential	Low Intensity Residential	Mixed Forest	Open Water	Other Grasses Urban/Recreational	Pasture/Hay	Quarries/Strip Mines/Gravel Pits	Row Crops	Transitional	Woody Wetlands	Unclassified
Lake Jackson (Newton, Butts, and Jasper Counties)	26 (0.0)	256063 (28.6)	937 (0.1)	159321 (17.8)	29580 (3.3)	0 (0.0)	14761 (1.6)	79816 (8.9)	170454 (19.0)	11846 (1.3)	16130 (1.8)	90873 (10.2)	2451 (0.3)	36404 (4.1)	5701 (0.6)	20838 (2.3)	0 (0.0)

Table 3 Waterbodies Listed for Fecal Coliform Bacteria in the Upper Ocmulgee River Basin (Source: EPD)

Stream Name	Segment Description	Segment Length (miles)	Designated Use Classification	Partially Supporting Designated Uses	Not Supporting Designated Uses
Alcovy River	Cedar Creek to Bay Creek	4	Fishing/ Drinking Water		X
Almand Branch	Tanyard Branch to Snapping Shoals	5	Fishing		X
Beaver Ruin Creek	Gwinnett County	8	Fishing	X	
Big Cotton Indian Creek	Panther Creek to Brush Creek	5	Fishing		X
Big Flat Creek	Headwaters to Flat Creek	13	Fishing		X
Big Haynes Creek	Brushy Creek to Little Panther Creek	2	Drinking Water	X	
Big Haynes Creek	Headwaters to Brushy Creek	9	Fishing/ Drinking Water	X	
Big Haynes Creek	Little Haynes Creek to Yellow River	5	Drinking Water	X	
Big Sandy Creek	Aboothlacoosta Creek to Ocmulgee River	10	Fishing		X
Bromolow Creek	Headwaters to Beaver Ruin Creek	5	Fishing	X	
Cabin Creek	Headwaters Griffin to Towaliga River	16	Fishing		X
Camp Creek	Headwaters to Jackson Creek	6	Fishing		X
Cedar Creek	Headwaters to Alcovy River	4	Fishing	X	
Falling Creek	Little Falling Creek to Ocmulgee River	9	Fishing		X
Hopkins Creek	Headwaters to Alcovy River	4	Fishing		X
Jacks Creek	Headwaters to Yellow River	4	Fishing		X
Jackson Creek	Gwinnett County	7	Fishing	X	
Little Haynes Creek	Hwy 20 to Big Haynes Creek	11	Fishing		X
Little Stone Mountain Creek	Headwaters to Stone Mountain Lake	3	Fishing		X
Little Suwanee Creek	Tributary to Yellow River	2	Fishing		X
No Business Creek	Headwaters to Norris Lake	6	Fishing		X

Stream Name	Segment Description	Segment Length (miles)	Designated Use Classification	Partially Supporting Designated Uses	Not Supporting Designated Uses
Ocmulgee River	Beaverdam Creek to Walnut Creek	10	Fishing/ Drinking Water	X	
Ocmulgee River	Tobesofkee Creek to Echeconnee Creek	7	Fishing	X	
Pew Creek	Gwinnett County	4	Fishing	X	
Rocky Creek	1 mile u/s Rocky Creek Road to Tobesofkee Creek	5	Fishing	X	
Shetley Creek	Headwaters to Bromolow Creek	2	Fishing		X
Shoal Creek	Headwaters to Alcovy River	5	Fishing		X
Snapping Shoals Creek	Almand Branch to South River	10	Fishing		X
South River	Atlanta to Flakes Mill Road	16	Fishing		X
South River	Flakes Mill Road to Pole Bridge Creek	9	Fishing		X
South River	Hwy 20 to Snapping Shoals Creek	11	Fishing	X	
South River	Pole Bridge Creek to Hwy 20	15	Fishing		X
South River	Snapping Shoals to Jackson Lake	7	Fishing	X	
Stone Mountain Creek	Headwaters to Stone Mountain Lake	4	Fishing		X
Sweetwater Creek	Lee Daniel Creek to Yellow River	6	Fishing		X
Swift Creek	Headwaters to Yellow River	5	Fishing		X
Tobesofkee Creek	Cole Creek to Todd Creek	8	Fishing		X
Tobesofkee Creek	Lake Tobesofkee to Rocky Creek	10	Fishing	X	
Town Branch	D/S Jackson South WPCP to Aboothlacoosta Creek	3	Fishing		X
Turkey Creek	Headwaters to Yellow River	4	Fishing		X
Tussahaw Creek	Wolf Creek to Lake Jackson	6	Fishing		X
Walnut Creek	Headwaters to Ocmulgee River	20	Fishing		X
Watson Creek	Headwaters to Yellow River	3	Fishing		X

Stream Name	Segment Description	Segment Length (miles)	Designated Use Classification	Partially Supporting Designated Uses	Not Supporting Designated Uses
Wise Creek	Headwaters to Ocmulgee River	6	Fishing		X
Yellow River	Big Haynes Creek to Jackson Lake	25	Fishing/ Drinking Water		X
Yellow River	Hwy 124 to Big Haynes Creek	16	Drinking Water	X	
Yellow River	Sweetwater Creek to Hwy 124	16	Fishing		X
Yellow Water Creek	1 mile d/s Stark Road	7	Fishing		X
Lake Jackson	Newton, Butts, and Jasper Counties	N/A*	Recreation		X

*Affected area equals 650 acres

Table 4 1999 Water Quality Monitoring Stations (Source: EPD)

Stream Name	Segment Description	USGS Monitoring Station No.	Monitoring Station Description
Alcovy River	Cedar Creek to Bay Creek	02208182	Alcovy River at State Road 81 near Loganville, Georgia
Almand Branch	Tanyard Branch to Snapping Shoals	02204748	Almand Branch at State Road 138 near Conyers, Georgia
Beaver Ruin Creek	Gwinnett County	No station	No station
Big Cotton Indian Creek	Panther Creek to Brush Creek	02204222	Big Cotton Indian Creek at Stockbridge Road near Stockbridge, Georgia
Big Flat Creek	Headwaters to Flat Creek	02208420	Big Flat Creek at U.S. Highway 78 near Loganville, Georgia
Big Haynes Creek	Brushy Creek to Little Panther Creek	02207412	Big Haynes Creek at State Road 20 near Conyers, Georgia
Big Haynes Creek	Headwaters to Brushy Creek	NA	NA
Big Haynes Creek	Little Haynes Creek to Yellow River	NA	NA
Big Indian Creek	Mossy Creek to Ocmulgee River	02214835	Big Indian Creek at State Road 247 near Kathleen, Georgia
Big Sandy Creek	Aboothlacoosta Creek to Ocmulgee River	02211199	Big Sandy Creek at State Road 87 near Sandy, Georgia
Bromolow Creek	Headwaters to Beaver Ruin Creek	02206030	Bromolow Creek at Shackelford Road near Norcross, Georgia
Cabin Creek	Headwaters Griffin to Towaliga River	02211380	Cabin Creek at State Road 16 near Griffin, Georgia
Camp Creek	Headwaters to Jackson Creek	02206235	Camp Creek at Killian Hill Road near Lilburn, Georgia
Cedar Creek	Headwaters to Alcovy River	02208180	Cedar Creek at Luke Edwards Road near Dacula, Georgia
Falling Creek	Little Falling Creek to Ocmulgee River	02212600	Falling Creek - FAS 1640 Near East Juliet
Hopkins Creek	Headwaters to Alcovy River	02208085	Hopkins Creek at Stanley Road near Dacula, Georgia
Jacks Creek	Headwaters to Yellow River	02207060	Jacks Creek at State Road 264 near Centerville, Georgia
Jackson Creek	Gwinnett County	02206300	Jackson Creek at Arcado Road near Luxomni, Georgia
Little Haynes Creek	Hwy 20 to Big Haynes Creek	02207430	Little Haynes Creek at State Road 138 near Conyers, Georgia
Little Stone Mountain Creek	Headwaters to Stone Mountain Lake	02207135	Little Stone Mountain Creek at Old Stone Mountain Road near Stone Mountain, Georgia
Little Suwanee Creek	Tributary to Yellow River	02205130	Little Suwanee Creek at Russell Road near Lawrenceville, Georgia

Stream Name	Segment Description	USGS Monitoring Station No.	Monitoring Station Description
No Business Creek	Headwaters to Norris Lake	02207185	No Business Creek at Lee Road near Snellville, Georgia
Ocmulgee River	Beaverdam Creek to Walnut Creek	02212950	Ocmulgee River - Macon Water Intake
Ocmulgee River	Tobesofkee Creek to Echeconnee Creek	02213700	Ocmulgee River - 6.0 Miles Downstream from Tobesofkee Creek
Pew Creek	Gwinnett County	02205522	Pew Creek at Patterson Road near Lawrenceville, Georgia
Rocky Creek	1 mile u/s Rocky Creek Road to Tobesofkee Creek	02213660 02213675	Rocky Creek at Log Cabin Drive near Macon, Georgia and Rocky Creek at Rocky Creek Road near Macon, Georgia
Shetley Creek	Headwaters to Bromolow Creek	02206000	Shetley Creek at Old Norcross Road near Norcross, Georgia
Shoal Creek	Headwaters to Alcovy River	02208140	Shoal Creek at Bramlett Shoals Road near Lawrenceville, Georgia
Snapping Shoals Creek	Almand Branch to South River	02204776	Snapping Shoals Creek at Bethany Road near Oak Hill, Georgia
South River	Atlanta to Flakes Mill Road	02203630 02203800	South River at Jonesboro Road at Atlanta, Georgia and South River at Bouldercrest Road
South River	Flakes Mill Road to Pole Bridge Creek	02203965	South River – Georgia Highway 155
South River	Hwy 20 to Snapping Shoals Creek	02204520	South River – Georgia Highway 81 at Snapping Shoals
South River	Pole Bridge Creek to Hwy 20	02204070 02204149	South River - Klondike Road and South River at State Road 20 near Kelleytown, Georgia
South River	Snapping Shoals to Jackson Lake	02204810	South River at Island Shoals Road near Snapping Shoals, Georgia
Stone Mountain Creek	Headwaters to Stone Mountain Lake	02207130	Stone Mountain Creek at Silver Hill Road near Stone Mountain, Georgia
Sweetwater Creek	Lee Daniel Creek to Yellow River	02206100	Sweetwater Creek at U.S. Highway 29 near Luxomni, Georgia
Swift Creek	Headwaters to Yellow River	02207200	Swift Creek at Conyers Street near Lithonia, Georgia
Tobesofkee Creek	Cole Creek to Todd Creek	02213300	Tobesofkee Creek at Parks Road near Forsyth, Georgia
Tobesofkee Creek	Lake Tobesofkee to Rocky Creek	02213560	Tobesofkee Creek – U.S. Highways 41 and 129
Town Branch	D/S Jackson S. WPCP to Aboothlacoosta Cr.	02211110	Town Branch at James Moore Drive (County Road 262) near Jackson, Georgia
Turkey Creek	Headwaters to Yellow River	02206448	Turkey Creek at Martin Nash Road near Snellville, Georgia

Stream Name	Segment Description	USGS Monitoring Station No.	Monitoring Station Description
Tussahaw Creek	Wolf Creek to Lake Jackson	02209750	Tussahaw Creek at Fincherville Road near Stark, Georgia
Walnut Creek	Headwaters to Ocmulgee River	02213055 02213110	Walnut Creek at McKay Road (County Road 11) near Clinton, Georgia and Walnut Creek at US Highway 80 near Macon, Georgia
Watson Creek	Headwaters to Yellow River	02206470	Watson Creek at High Point Road near Snellville, Georgia
Wise Creek	Headwaters to Kinnard Creek	02210998	Wise Creek at Concord Road (County Road 141) near Monticello, Georgia
Yellow River	Big Haynes Creek to Jackson Lake	02208005	Yellow River - Georgia Highway 212
Yellow River	Hwy 124 to Big Haynes Creek	02207300	Yellow River - Conyers Water Intake
Yellow River	Sweetwater Creek to Hwy 124	02206500	Yellow River – Killian Hill Road
Yellow Water Creek	1 mile d/s Stark Road	02210780	Yellow Water Creek at State Road 16 near Jackson, Georgia
Lake Jackson	Newton, Butts, and Jasper Counties	04350051*	Lake Jackson downstream from Alcovy River confluence

*Georgia monitoring station number; no corresponding USGS station

Table 5 Water Quality Monitoring Data for 303(d) Listed Streams in the Upper Ocmulgee River Basin (Source: EPD)

Stream/Segment	Sample Dates	Fecal Coliform Bacteria (#/100 ml)	Geometric Mean (#/100 ml)	Sample Dates	Fecal Coliform Bacteria (#/100 ml)	Geometric Mean (#/100 ml)	Sample Dates	Fecal Coliform Bacteria (#/100 ml)	Geometric Mean (#/100 ml)	Sample Dates	Fecal Coliform Bacteria (#/100 ml)	Geometric Mean (#/100 ml)
Alcovy River (Cedar Creek to Bay Creek)	02/12/1999 02/16/1999 02/22/1999 03/05/1999	70 20 20 170	47	04/08/1999 04/13/1999 04/20/1999 04/29/1999	230 60 20 110	74	06/10/1999 06/17/1999 06/24/1999 07/08/1999	130 1700 140 700	384	09/09/1999 09/23/1999 09/30/1999 10/07/1999	330 790 130 490	359
Alligator Creek (Batson Creek to Lime Sink Creek)	04/06/1999 04/15/1999 04/22/1999 04/28/1999	80 490 1700 4900	756	05/20/1999 05/27/1999 06/10/1999 06/17/1999	490 460 490 1700	658	07/29/1999	490		08/12/1999	490	
Almand Branch (Tanyard Branch to Snapping Shoals)	02/11/1999 02/17/1999 02/23/1999 03/03/1999	790 20 20 460	110	04/07/1999 04/12/1999 04/19/1999 04/28/1999	230 50 130 170	126	06/09/1999 06/16/1999 06/23/1999 07/07/1999	230 1300 490 7900	1037	09/08/1999 09/22/1999 09/29/1999 10/06/1999	80 170 11000 130	373
Big Cotton Indian Cr. (Panther Creek to Brush Creek)	02/11/1999 02/17/1999 02/23/1999 03/03/1999	220 220 220 280	234	04/07/1999 04/12/1999 04/19/1999 04/28/1999	170 330 490 1300	435	06/09/1999 06/16/1999 06/23/1999 07/07/1999	490 790 330 460	492	09/08/1999 09/22/1999 09/29/1999 10/06/1999	270 3500 >24000 490	1826
Big Flat Creek (Headwaters to Flat Creek)	02/12/1999 02/16/1999 02/22/1999	170 80 260 80	130	04/08/1999 04/13/1999 04/20/1999 04/29/1999	4100 790 460 7000	1797	06/10/1999 06/17/1999 06/24/1999 07/08/1999	330 490 5400 3300	1303	09/09/1999 09/23/1999 09/30/1999 10/07/1999	1300 340 330 2300	761
Big Haynes Creek (Brushy Creek to Little Panther Creek)	2/12/1999 2/16/1999 2/22/1999 3/05/1999	230 70 330 220	185	6/10/1999 6/17/1999 6/24/1999 07/08/1999	270 490 60 1100	306	04/08/1999 04/13/1999 04/20/1999	130 80 330		09/09/1999 09/30/1999 10/07/1999	170 80 130	
Big Haynes Creek (Headwaters to Brushy Creek)												
Big Haynes Creek (Little Haynes Creek to Yellow River)												
Big Sandy Creek (Aboothlacoosta Creek to Ocmulgee River)	01/21/1999 01/26/1999 02/04/1999 04/16/1999	70 130 330 490	196	03/30/1999 04/13/1999 04/20/1999 04/27/1999	20 80 50 140	58	06/22/1999 06/29/1999 07/13/1999 07/20/1999	230 2400 170 130	332	09/21/1999 29/28/1999 10/06/1999 10/19/1999	330 210 230 280	258
Bromolow Creek (Headwaters to Beaver Ruin Creek)	03/09/1999 03/15/1999 03/18/1999 03/24/1999	<20 130 20 170	55	05/03/1999 05/12/1999 05/18/1999 06/02/1999	330 230 50 130	149	07/06/1999 07/19/1999 07/22/1999 07/28/1999	3500 220 9200 1100	1671	11/01/1999 11/04/1999 11/15/1999 11/18/1999	220 1300 130 130	264
Cabin Creek (Headwaters Griffin to Towaliga River)	02/25/1999 03/01/1999 03/08/1999 03/11/1999	40 170 140 330	133	04/06/1999 04/14/1999 04/21/1999 04/27/1999	110 1400 330 170	305	06/08/1999 06/15/1999 06/22/1999 07/06/1999	1300 940 460 330	656	09/07/1999 09/21/1999 09/28/1999 10/05/1999	490 790 490 4900	982
Camp Creek (Headwaters to Jackson Creek)	03/09/1999 03/15/1999 03/18/1999 03/24/1999	790 330 110 110	237	03/03/1999 03/12/1999 03/18/1999 06/02/1999	130 330 140 460	229	07/06/1999 07/19/1999 07/22/1999 07/28/1999	460 490 330 630	465	11/01/1999 11/04/1999 11/15/1999 11/18/1999	170 330 220 20	125

Stream/Segment	Sample Dates	Fecal Coliform Bacteria (#/100 ml)	Geometric Mean (#/100 ml)	Sample Dates	Fecal Coliform Bacteria (#/100 ml)	Geometric Mean (#/100 ml)	Sample Dates	Fecal Coliform Bacteria (#/100 ml)	Geometric Mean (#/100 ml)	Sample Dates	Fecal Coliform Bacteria (#/100 ml)	Geometric Mean (#/100 ml)
Cedar Creek (Headwaters to Alcovy River)	03/09/1999 03/15/1999 03/18/1999 03/24/1999	80 40 170 80	81	05/03/1999 05/12/1999 05/18/1999 06/02/1999	80 500 50 20	80	07/06/1999 07/19/1999 07/22/1999 07/28/1999	230 330 140 230	222	11/01/1999 11/04/1999 11/15/1999 11/18/1999	110 50 70 <20	53
Falling Creek (Little Falling Creek to Ocmulgee River)	01/21/1999 01/26/1999 02/04/1999 02/16/1999	490 130 50 170	153	03/30/1999 04/13/1999 04/20/1999 04/27/1999	230 80 70 130	114	06/22/1999 06/29/1999 07/13/1999 07/20/1999	130 230 170 490	223	09/21/1999 09/28/1999 10/06/1999 10/19/1999	80 1300 230 140	241
Hopkins Creek (Headwaters to Alcovy River)	03/09/1999 03/15/1999 03/18/1999 03/24/199	490 50 <20 80	79	05/03/1999 05/12/1999 05/18/1999 06/02/1999	80 790 330 330	288	07/06/1999 07/19/1999 07/22/1999 07/28/1999	490 170 490 110	259	11/01/1999 11/04/1999 11/15/1999 11/18/1999	<20 20 50 110	39
Jacks Creek (Headwaters to Yellow River)	03/11/1999 03/17/1999 03/23/1999 04/08/1999	80 460 20 80	88	05/06/1999 05/17/1999 05/20/1999 06/03/1999	>24000 1100 1100 3500	3137	07/08/1999 07/21/1999 07/27/1999 08/02/1999	2400 1700 490 1100	1218	11/03/1999 11/09/1999 11/17/1999 11/23/1999	940 230 460 260	401
Jackson Creek (Gwinnett County)	03/09/1999 03/15/1999 03/18/1999 03/24/1999	1700 60 <20 330	161	05/03/1999 05/12/1999 05/18/1999 06/02/1999	170 340 130 70	151	07/06/1999 07/19/1999 07/22/1999 07/28/1999	490 2200 330 230	535	11/01/1999 11/04/1999 11/15/1999 11/18/1999	230 700 60 110	181
Little Haynes Creek (Hwy 20 to Big Haynes Creek)	02/12/1999 02/16/1999 02/22/1999 03/05/1999	220 80 20 70	70	04/08/1999 04/13/199 04/20/1999 04/29/1999	230 130 170 790	252	07/10/1999 07/17/1999 07/24/1999 08/08/1999	130 1300 80 700	252	09/09/1999 09/23/1999 09/30/1999 10/07/1999	130 2800 700 110	409
Little Stone Mountain Creek (Headwaters to Stone Mountain Lake)	03/11/1999 03/17/1999 03/23/1999 04/08/1999	130 80 70 170	105	05/06/1999 05/17/1999 05/20/1999 06/03/1999	790 130 790 3100	708	0708/1999 0721/1999 0727/1999 08/02/1999	330 490 310 790	446	11/03/1999 11/09/1999 11/17/1999 11/23/1999	790 490 110 170	292
Little Suwannee Creek (Tributary to Yellow River)	03/09/1999 03/15/1999 03/18/1999 03/24/1999	2400 60 110 70	182	05/03/1999 05/12/1999 05/18/1999 06/02/1999	330 490 790 5400	911	07/06/1999 07/19/1999 07/22/1999 07/28/1999	310 1700 2400 3500	1451	11/01/1999 11/04/1999 11/15/1999 11/18/1999	490 490 330 790	500
No Business Creek (Headwaters to Norris Lake)	03/11/1999 03/17/1999 03/23/1999 04/08/1999	140 50 20 330	82	05/06/1999 05/17/1999 05/20/1999 06/03/1999	16000 330 20 140	349	07/08/1999 07/21/1999 07/27/1999 08/02/1999	80 1100 130 220	224	11/03/1999 11/09/1999 11/17/1999 11/23/1999	80 170 40 50	72
Ocmulgee River (Beaverdam Creek to Walnut Creek)	01/20/1999 01/28/1999 02/03/1999 02/17/1999	20 50 700 330	123	03/31/1999 04/15/1999 04/22/1999 04/29/1999	20 80 40 20	34	06/24/1999 07/01/1999 07/15/1999 07/22/1999	50 330 210 490	203	09/23/1999 09/30/1999 10/07/1999 10/21/1999	330 <20 <20 50	51
Ocmulgee River (Tobesofkee Creek to Echeconnee Creek)	01/20/1999 01/28/1999 02/03/1999 02/17/1999	20 110 1300 110	133	03/31/1999 04/15/1999 04/22/1999 04/29/1999	50 40 20 <20	30	06/24/1999 07/01/1999 07/15/1999 07/22/1999	230 170 490 460	306	09/23/1999 09/30/1999 10/07/1999 10/21/1999	<20 140 230 80	85
Pew Creek (Gwinnett County)	03/09/1999 03/15/1999 03/18/1999 03/24/1999	130 170 <20 20	55	05/03/1999 05/12/1999 05/18/1999 06/02/1999	40 490 110 230	149	07/06/1999 07/19/1999 07/22/1999 07/28/1999	490 330 3500 170	557	11/01/1999 11/04/1999 11/15/1999 11/18/1999	490 330 330 130	289
Rocky Creek (1 mile u/s Rocky Cr. Rd. to Tobesofkee Cr.)	03/31/1999 04/15/1999 04/22/1999 04/29/1999	330 1100 460 230	443	06/24/1999 07/01/1999 07/15/1999 07/22/1999	330 170 80 170	166	09/23/1999 09/30/1999 10/07/1999 10/21/1999	1300 170 230 330	360			

Stream/Segment	Sample Dates	Fecal Coliform Bacteria (#/100 ml)	Geometric Mean (#/100 ml)	Sample Dates	Fecal Coliform Bacteria (#/100 ml)	Geometric Mean (#/100 ml)	Sample Dates	Fecal Coliform Bacteria (#/100 ml)	Geometric Mean (#/100 ml)	Sample Dates	Fecal Coliform Bacteria (#/100 ml)	Geometric Mean (#/100 ml)
Shetley Creek (Headwaters to Bromolow Creek)	03/09/1999 03/15/1999 03/18/1999 03/24/1999	490 170 130 260	230	05/03/1999 05/12/1999 05/18/1999 06/02/1999	110 4300 220 1100	582	06/06/1999 06/19/1999 06/22/1999 06/28/1999	2400 790 2200 3500	1955	11/01/1999 11/04/1999 11/15/1999 11/18/1999	490 3500 1400 110	719
Shoal Creek (Headwaters to Alcovy River)	03/09/1999 03/15/1999 03/18/1999 03/24/1999	1100 130 790 230	401	05/03/1999 05/12/1999 05/18/1999 06/02/1999	330 1300 230 130	337	07/06/1999 07/19/1999 07/22/1999 07/28/1999	2400 20 1400 790	480	11/01/1999 11/04/1999 11/15/1999 11/18/1999	40 790 170 490	227
Snapping Shoals Creek (Almand Branch to South River)	03/10/1999 03/16/1999 03/22/1999 03/25/1999	<20 170 110 1100	142	05/04/1999 05/13/1999 05/17/1999 05/19/1999	790 490 1300 2200	1026	07/07/1999 07/20/1999 07/26/1999 07/29/1999	4600 300 330 700	751	11/08/1999 11/16/1999 11/22/1999 11/29/1999	110 50 130 <20	61
South River (Atlanta to Flakes Mill Road)	02/11/1999 02/17/1999 02/23/1999 03/03/1999	1100 170 90 170	231	04/07/1999 04/12/1999 04/19/1999 04/28/1999	330 490 1300 35000	1647	06/09/1999 06/16/1999 06/23/1999 07/07/1999	460 24000 330 240000	5438	09/08/1999 09/22/1999 09/29/1999 10/06/1999	1700 9200 5400 4600	4440
South River (Flakes Mill Road to Pole Bridge Creek)	02/11/1999 02/17/1999 02/23/1999 03/03/1999	2200 230 1700 130	578	04/07/1999 04/12/1999 04/19/1999 04/28/1999	130 130 790 24000	752	06/09/1999 06/16/1999 06/23/1999 07/07/1999	330 230 170 14000	652	09/08/1999 09/22/1999 09/29/1999 10/06/1999	110 3500 >24000 230	1207
South River (Hwy 20 to Snapping Shoals Creek)	01/07/1999 01/13/1999 01/20/1999 02/04/1999	230 310 20 1100	199	04/06/1999 04/14/1999 04/21/1999 04/27/1999	80 1100 790 170	330	06/08/1999 06/15/1999 06/22/1999 07/06/1999	220 110 130 230	164	09/07/1999 09/21/1999 09/28/1999 10/05/1999	170 110 790 790	584
South River (Pole Bridge Creek to Hwy 20)	02/11/1999 02/17/1999 02/23/1999 03/03/1999	4900 110 <20 50	152	04/07/1999 04/12/1999 04/19/1999 04/28/1999	70 490 1100 790	416	06/09/1999 06/16/1999 06/23/1999 07/07/1999	60 790 130 2300	345	09/08/1999 09/22/1999 09/29/1999 10/06/1999	170 490 >24000 1300	1270
South River (Snapping Shoals to Jackson Lake)	01/04/1999 01/21/1999 01/25/1999 02/03/1999	20 110 213 1700	184	05/06/1999 05/11/1999 05/18/1999 06/03/1999	640 110 20 1100	198.4	09/03/1999 09/15/1999 09/22/1999 09/30/1999	790 70 40 13000	411.8	11/19/1999 11/22/1999 12/08/1999 12/15/1999	80 20 80 330	80.6
Stone Mountain Creek (Headwaters to Stone Mountain Lake)	03/11/1999 03/17/1999 03/23/1999 04/08/1999	230 70 20 50	63	05/06/1999 05/17/1999 05/20/1999 06/03/1999	210 80 330 3500	373	07/08/1999 07/21/1999 07/27/1999 08/02/1999	230 70 790 700	307	11/03/1999 11/09/1999 11/17/1999 11/23/1999	490 20 50 50	70
Sweetwater Creek (Lee Daniel Creek to Yellow River)	02/12/1999 02/16/1999 02/22/1999 03/05/1999	160 790 40 80	142	04/08/1999 04/13/1999 04/20/1999 04/29/1999	170 170 110 790	224	06/10/1999 06/17/1999 06/24/1999 07/08/1999	220 11000 700 490	955	09/09/1999 09/23/1999 09/30/1999 10/07/1999	460 220 490 900	460
Swift Creek (Headwaters to Yellow River)	03/11/1999 03/17/1999 03/23/1999 04/08/1999	790 790 80 330	358	05/06/1999 05/17/1999 05/20/1999 06/03/1999	16000 730 230 >24000	1920	07/08/1999 07/21/1999 07/27/1999 08/02/1999	490 3500 330 330	657	11/03/1999 11/09/1999 11/17/1999 11/23/1999	1100 110 210 230	276
Tobesofkee Creek (Cole Creek to Todd Creek)	01/21/1999 01/26/1999 02/04/1999 02/16/1999	20 1300 790 490	317	03/30/1999 04/13/1999 04/20/1999 04/27/1999	90 50 50 230	85	06/22/1999 06/29/1999 07/13/1999 07/20/1999	460 9200 170 4900	1370	09/21/1999 09/28/1999 10/06/1999 10/19/1999	700 460 110 50	205
Tobesofkee Creek (Lake Tobesofkee to Rocky Creek)	01/20/1999 01/28/1999 02/03/1999 02/17/1999	20 80 700 20	69	03/31/1999 04/15/1999 04/22/1999 04/29/1999	20 50 50 130	50	06/24/1999 07/01/1999 07/15/1999 07/22/1999	270 110 170 200	178	09/23/1999 09/30/1999 10/07/1999 10/21/1999	230 1400 270 490	454
Town Branch (D/S Jackson S. WPCP to Aboothlacoosta Cr.)	01/21/1999 01/26/1999 02/16/199	220 490 330		03/30/1999 04/13/1999 04/22/1999	330 7900 460		07/20/1999 09/21/1999 10/19/1999	4900 35000 260				

Stream/Segment	Sample Dates	Fecal Coliform Bacteria (#/100 ml)	Geometric Mean (#/100 ml)	Sample Dates	Fecal Coliform Bacteria (#/100 ml)	Geometric Mean (#/100 ml)	Sample Dates	Fecal Coliform Bacteria (#/100 ml)	Geometric Mean (#/100 ml)	Sample Dates	Fecal Coliform Bacteria (#/100 ml)	Geometric Mean (#/100 ml)
Turkey Creek (Headwaters to Yellow River)	03/11/1999 03/17/1999 03/23/1999 04/08/1999	<20 50 20 230	46	03/06/1999 03/17/1999 03/20/1999 04/03/1999	17000 330 490 330	976	07/08/1999 07/21/1999 07/27/1999 08/02/1999	1700 790 270 490	649	11/03/1999 11/09/1999 11/17/1999 11/23/1999	200 170 80 490	356
Turnpike Creek (Hwy 280 to Sugar Creek)	04/01/1999 04/08/1999 04/14/1999 04/21/1999	6400 110 490 110	441	05/19/1999 07/28/1999 08/11/1999	160 170 <20		12/08/1999 12/15/1999	20 110				
Tussahaw Creek (Wolf Creek to Lake Jackson)	01/07/1999 01/13/1999 01/20/1999 02/04/1999	490 220 20 170	138	04/06/1999 04/14/1999 04/21/1999 04/27/1999	270 460 220 490	340	06/08/1999 06/15/1999 06/22/1999 07/06/1999	330 230 330 330	302	09/07/1999 09/21/1999 09/28/1999 10/05/1999	230 5400 11000 1800	2227
Walnut Creek (Headwaters to Ocmulgee River)	01/20/1999 01/28/1999 02/03/1999 02/17/1999	20 3300 >24000 1100	1149	03/31/1999 04/15/1999 04/22/1999 04/29/1999	280 330 230 230	264	06/24/1999 07/01/1999 07/15/1999 07/22/1999	2200 50 490 220	330	09/23/1999 09/30/1999 10/07/1999 10/21/1999	20 70 3500 130	159
Watson Creek (Headwaters to Yellow River)	03/11/1999 03/17/1999 03/23/1999 04/08/1999	80 <20 <20 80	40	05/06/1999 05/17/1999 05/20/1999 06/03/1999	>24000 330 110 230	669	07/08/1999 07/21/1999 07/27/1999 08/02/1999	460 5400 170 330	611	11/03/1999 11/09/1999 11/17/1999 11/23/1999	490 50 50 20	70
Wise Creek (Headwaters to Kinnard Creek)	01/21/1999 01/26/1999 02/04/1999 02/16/1999	80 130 80 230	114	03/30/1999 04/13/1999 04/20/1999 04/27/1999	50 460 50 330	140	06/22/1999 06/29/1999 07/13/1999 07/20/1999	330 170 330 490	309	09/21/1999 09/28/1999 10/06/1999 10/19/1999	490 230 2200 50	334
Yellow River (Big Haynes Creek to Jackson Lake)	01/07/1999 01/13/1999 01/20/1999 02/04/1999	940 330 20 790	265	04/06/1999 04/14/1999 04/21/1999 04/27/1999	50 80 220 80	92	06/08/1999 06/15/1999 06/22/1999 07/06/1999	790 330 80 330	288	09/07/1999 09/21/1999 09/28/1999 10/05/1999	1100 490 460 3000	929
Yellow River (Hwy 124 to Big Haynes Creek)	02/12/1999 02/16/1999 02/22/1999 03/05/1999	790 40 50 80	106	07/10/1999 07/17/1999 07/24/1999 08/08/1999	20 490 110 2200	221	09/09/1999 09/23/1999 09/30/1999 10/07/1999	80 130 700 140	179			
Yellow River (Sweetwater Creek to Hwy 124)	02/12/1999 02/16/1999 02/22/1999 03/05/1999	170 270 66 50	111	04/08/1999 04/13/1999 04/20/1999 04/29/1999	210 20 230 330	134	06/10/1999 06/17/1999 06/24/1999 07/08/1999	330 11000 170 1100	908	09/09/1999 09/23/1999 09/30/1999 10/07/1999	170 170 310 1300	329
Yellow Water Creek (1 mile d/s Stark Road)	01/21/1999 01/26/1999 02/04/1999 02/16/1999	50 490 790 2200	454	03/30/1999 04/13/1999 04/20/1999 04/27/1999	80 20 50 60	47	06/22/1999 06/29/1999 07/13/1999 07/20/1999	790 9200 790 230	1072	09/21/1999 09/28/1999 10/06/1999 10/19/1999	1300 110 <130 140	226
Lake Jackson ("Newton, Butts, and Jasper Counties")												

Table 6 NPDES Facilities Discharging Fecal Coliform (Source: EPD)

Facility Name	NPDES Permit No.	1999 Discharge Monitoring Reports		NPDES Permit Limits	
		Avg. Flow (MGD)	Avg. Fecal Coliform Loading[a] (counts/hr)	Avg. Flow (MGD)	Avg. Fecal Coliform Loading[b] (counts/hr)
Atlanta Custer Ave. CSO	GA0037141	See Note C		See Note C	
Atlanta Intrenchment Cr CSO	GA0037168	See Note C		See Note C	
Atlanta McDaniel St. CSO	GA0037133	See Note C		See Note C	
Atlanta South River WRC	GA0024040	No data available		0.0065	2.04E+05
Barnesville Gordon Road	GA0021041	0.85	7.88E+07	1.20	3.79E+08
Clayton Co Northeast WPCP	GA0020575	3.98	1.79E+08	6.00	1.90E+09
DeKalb Co Polebridge WPCP	GA0026816	9.55	0.00E+00	20.00	6.32E+09
DeKalb Co Snapfinger WPCP	GA0024147	20.58	1.71E+08	36.00	1.14E+10
DNR High Falls State Park	GA0048135	No data available		0.02	6.32E+06
DOT Rest Area #22	GA0023591	No data available		0.045	1.42E+07
Forsyth Northeast	GA0031801	No data available		1.40	4.42E+08
Forsyth South	GA0024732	0.28	4.83E+05	0.60	1.90E+08
Georgia Power Arkwright	GA0026069	No data available		480.85	1.52E+11
Griffin Cabin Creek	GA0020214	1.05	1.02E+07	1.50	4.74E+08
Gwinnett Co Beaver Ruin Creek	GA0032841	4.40	1.62E+07	4.50	1.42E+09
Gwinnett Co Big Haynes Creek	GA0033847	0.24	1.34E+06	0.50	1.58E+08
Gwinnett Co Jacks Creek	GA0047627	0.50	2.44E+06	1.00	3.16E+08
Gwinnett Co Jackson Creek	GA0030732	2.86	6.79E+06	3.00	9.48E+08
Gwinnett Co No Business Creek	GA0023973	0.84	5.24E+06	1.00	3.16E+08
Gwinnett Co Yellow River	GA0047911	10.21	3.80E+07	12.00	4.74E+08
Henry Co Camp Creek	GA0049352	1.02	4.85E+07	1.50	4.74E+08
Henry Co Hudson Bridge WPCP	GA0034711	0.46	4.64E+07	0.40	1.26E+08
Henry Co Panola Woods WPCP	GA0049808	0.08	2.46E+06	0.001	3.16E+05
Jackson Northeast	GA0032719	No data available		0.038	1.20E+07
Jackson Southside	GA0023931	0.28	1.30E+06	0.70	2.21E+08
Jackson Yellow Water Creek	GA0021831	0.20	2.73E+05	0.75	2.37E+08
Locust Grove East Pond	GA0049760	0.03	0.00E+00	0.05	1.58E+07
Locust Grove Skyland MHP	GA0049816	0.13	2.69E+07	0.20	6.32E+07
Locust Grove West Pond	GA0049778	0.10	0.00E+00	0.05	1.64E+07
Loganville WPCP	GA0020788	0.41	2.67E+06	0.575	1.82E+08
Macon Poplar Street	GA0024538	15.13	5.85E+08	20.00	6.32E+09
Macon Rocky Creek	GA0024546	20.48	7.60E+08	24.00	7.58E+09
Rockdale Co Almand WPCP	GA0021610	0.90	7.74E+06	1.25	3.95E+08
Rockdale Co Honey Creek	GA0022659	0.22	4.84E+06	0.30	9.48E+07
Rockdale Co Quigg Branch	GA0047678	2.80	1.53E+07	4.00	1.26E+09
Rockdale Co Scott Creek	GA0026239	0.22	3.06E+07	0.22	6.95E+07
Rockdale Co Snapping Shoals	GA0023035	0.35	3.42E+06	0.45	1.42E+08
Spring Industries Inc	GA0003409	1.02	5.29E+07	1.00	6.32E+08
Stockbridge WPCP	GA0023337	0.51	2.66E+06	1.50	4.74E+08
William Carter Co	GA0003115	No data available		1.30	4.11E+08

a Loadings based on CY 1999 average fecal coliform concentration and mean flow reported on DMRs.

b Loadings based on Monthly Average fecal coliform permit limit and monthly average permitted flow (design flow used for facilities without a permitted monthly flow limit). A fecal coliform loading of 200 counts/100 mL was assumed for facilities without a fecal coliform bacteria permit limit.

C Flow and fecal coliform load dependent on specific storm events. Fecal coliform permit limits mirrors instream standard of 200 cnts/100mL May-October; 1,000 cnts/100mL November through April. (Source: EPD)

Table 7 Livestock Distribution By County in the Ocmulgee River Basin (USDA, 1997)

County	Livestock						
	Beef Cow	Milk Cow	Cattle	Chicken Layers	Chickens-Broilers Sold	Hogs	Sheep
Fulton	1662	0	3036	0	0	53	0
Dekalb	697	0	1355	0	0	0	0
Rockdale	0	0	1127	0	0	195	180
Clayton	721	0	1328	0	0	0	0
Henry	0	0	8553	0	0	22	42
Gwinnett	0	0	4803	0	1,967,683	22	22
Newton	4695	213	8785	0	850,000	146	0
Walton	6086	45	11,979	161,009	8,973,250	219	145
Butts	2915	222	6054	0	0	0	0
Jasper	5407	1019	9983	525,752	914,348	0	157
Spaulding	2531	778	5265	0	0	0	0
Monroe	3346	1433	8022	0	7,474,929	96	0
Lamar	4211	1336	8867	0	0	19	0
Jones	3265	1289	7264	0	1832,000	0	0
Bibb	1360	355	2689	0	1,676,116	226	0

Table 8 Fecal Coliform Loading Rates for Existing Conditions During Critical Period

Stream/Segment	Critical Conditions Period	Loading from NPDES Discharges (counts/30 days)	Loading from Surface Runoff and Other Direct Sources (counts/30 days)
Alcovy River - (Cedar Creek to Bay Creek)	7/24 – 8/22/99	0	1.10×10^{13}
Almand Branch - (Tanyard Branch to Snapping Shoals)	8/22 – 9/20/99	2.84×10^{11}	2.31×10^{12}
Beaver Ruin Creek - (Gwinnett County)	6/25 – 7/24/99	0	2.83×10^{13}
Big Cotton Indian Creek - (Panther Creek to Brush Creek)	8/22 – 9/20/99	0	1.48×10^{13}
Big Flat Creek - (Headwaters to Flat Creek)	7/24 – 8/22/99	1.31×10^{11}	8.42×10^{12}
Big Haynes Creek - (Headwaters to Yellow River) – **3 TMDL segments**	6/25 – 7/24/99	1.14×10^{11}	1.71×10^{13}
Big Sandy Creek - (Aboothlacoosta Creek to Ocmulgee River)	7/14 – 8/12/93	1.59×10^{11}	1.36×10^{12}
Bromolow Creek - (Headwaters to Beaver Ruin Creek)	6/25 – 7/24/99	0	2.95×10^{13}
Cabin Creek - (Headwaters Griffin to Towaliga River)	5/1 – 5/30/95	7.96×10^{11}	7.31×10^{11}
Camp Creek - (Headwaters to Jackson Creek)	6/25 – 7/24/99	0	1.25×10^{13}
Cedar Creek - (Headwaters to Alcovy River)	7/24 – 8/22/99	0	3.60×10^{11}
Falling Creek - (Little Falling Creek to Ocmulgee River)	6/15 – 7/14/90	0	1.42×10^{11}
Hopkins Creek - (Headwaters to Alcovy River)	7/24 – 8/22/99	0	7.90×10^{11}
Jacks Creek - (Headwaters to Yellow River)	6/25 – 7/24/99	2.28×10^{11}	1.67×10^{12}
Jackson Creek - (Gwinnett County)	6/25 – 7/24/99	6.83×10^{11}	3.72×10^{13}
Little Haynes Creek - (Hwy 20 to Big Haynes Creek)	6/25 – 7/24/99	0	2.47×10^{12}
Little Stone Mountain Creek - (Headwaters to Stone Mountain Lake)	6/25 – 7/24/99	0	1.59×10^{12}
Little Suwanee Creek - (Tributary to Yellow River)	6/25 – 7/24/99	0	1.79×10^{12}
No Business Creek - (Headwaters to Norris Lake)	6/25 – 7/24/99	2.28×10^{11}	6.54×10^{12}
Ocmulgee River - (Beaverdam Creek to Walnut Creek)	7/17 – 8/15/92	7.67×10^{12}	6.48×10^{14}
Ocmulgee River - (Tobesofkee Creek to Echeconnee Creek)	9/14 – 10/13/99	1.22×10^{13}	9.83×10^{14}
Pew Creek - (Gwinnett County)	6/25 – 7/24/99	0	1.53×10^{13}

Stream/Segment	Critical Conditions Period	Loading from NPDES Discharges (counts/30 days)	Loading from Surface Runoff and Other Direct Sources (counts/30 days)
Rocky Creek - (1 mile u/s Rocky Creek Rd. - Tobesofkee Cr.)	4/28 – 5/27/95	5.46×10^{12}	7.86×10^{13}
Shetley Creek - (Headwaters to Bromolow Creek)	6/25 – 7/24/99	0	2.74×10^{12}
Shoal Creek - (Headwaters to Alcovy River)	7/24 – 8/22/99	0	3.03×10^{12}
Snapping Shoals Creek - (Almand Branch to South River)	8/22 – 9/20/99	2.84×10^{11}	6.33×10^{12}
South River - (Atlanta to Flakes Mill Road)	8/7 – 9/5/98	1.092×10^{16}	3.89×10^{13}
South River - (Flakes Mill Road to Pole Bridge Creek)	8/7 – 9/5/98	1.092×10^{16}	5.62×10^{13}
South River - (Pole Bridge Creek to Hwy 20)	8/7 – 9/5/98	1.092×10^{16}	7.12×10^{13}
South River – (Hwy 20 to Snapping Shoals Creek and Snapping Shoals Creek to Jackson Lake)	8/7 – 9/5/98	1.092×10^{16}	1.91×10^{14}
Stone Mountain Creek - (Headwaters to Stone Mountain Lake)	6/25 – 7/24/99	0	4.71×10^{12}
Sweetwater Creek - (Lee Daniel Creek to Yellow River)	6/25 – 7/24/99	1.70×10^{12}	2.19×10^{14}
Swift Creek - (Headwaters to Yellow River)	6/25 – 7/24/99	0	2.71×10^{12}
Tobesofkee Creek - (Cole Creek to Todd Creek)	5/1 – 5/30/95	7.06×10^{11}	3.90×10^{12}
Tobesofkee Creek - (Lake Tobesofkee to Rocky Creek)	5/1 – 5/30/95	5.69×10^{11}	7.81×10^{11}
Town Branch - (D/S Jackson S. WPCP to Aboothlacoosta Cr.)	5/13 – 6/11/92	1.59×10^{11}	9.77×10^{12}
Turkey Creek - (Headwaters to Yellow River)	6/25 – 7/24/99	0	7.30×10^{11}
Tussahaw Creek - (Wolf Creek to Lake Jackson)	6/14 – 7/13/94	5.69×10^{10}	1.27×10^{15}
Walnut Creek - (Headwaters to Ocmulgee River)	5/1 – 5/30/95	0	6.96×10^{13}
Watson Creek - (Headwaters to Yellow River)	6/25 – 7/24/99	0	2.35×10^{11}
Wise Creek - (Headwaters to Kinnard Creek)	8/2 – 8/31/90	0	7.31×10^{11}
Yellow River - (Big Haynes Creek to Jackson Lake)	6/25 – 7/24/99	3.00×10^{12}	1.91×10^{14}
Yellow River - (Hwy 124 to Big Haynes Creek)	6/25 – 7/24/99	2.89×10^{12}	1.91×10^{14}
Yellow River - (Sweetwater Creek to Hwy 124)	6/25 – 7/24/99	2.27×10^{12}	5.18×10^{12}

Stream/Segment	Critical Conditions Period	Loading from NPDES Discharges (counts/30 days)	Loading from Surface Runoff and Other Direct Sources (counts/30 days)
Yellow Water Creek - (1 mile d/s Stark Road)	7/4 – 8/2/93	2.05×10^{11}	1.73×10^{12}

Table 9 TMDL Components

Stream Name	Segment Description	WLAs (counts/30 days)	LAs (counts/30 days)	Margin of Safety	TMDL (counts/30 days)	Percent Reduction
Alcovy River	Cedar Creek to Bay Creek	0	4.27×10^{12}	4.74×10^{11}	4.74×10^{12}	57
Almand Branch	Tanyard Branch to Snapping Shoals	2.84×10^{11}	4.40×10^{11}	4.89×10^{10}	7.73×10^{11}	79
Beaver Ruin Creek	Gwinnett County	0	2.80×10^{12}	3.11×10^{11}	3.11×10^{12}	89
Big Cotton Indian Creek	Panther Creek to Brush Creek	0	2.02×10^{12}	2.25×10^{11}	2.25×10^{12}	80
Big Flat Creek	Headwaters to Flat Creek	1.31×10^{11}	6.41×10^{12}	7.12×10^{11}	7.26×10^{12}	15
Big Haynes Creek	Brushy Creek to Little Panther Creek	1.14×10^{11}	2.31×10^{12}	2.57×10^{11}	2.68×10^{12}	85
Big Haynes Creek	Headwaters to Brushy Creek	1.14×10^{11}	2.31×10^{12}	2.57×10^{11}	2.68×10^{12}	85
Big Haynes Creek	Little Haynes Creek to Yellow River	1.14×10^{11}	2.31×10^{12}	2.57×10^{11}	2.68×10^{12}	85
Big Sandy Creek	Aboothlacoosta Creek to Ocmulgee River	1.59×10^{11}	3.61×10^{11}	4.01×10^{10}	5.60×10^{11}	66
Bromolow Creek	Headwaters to Beaver Ruin Creek	0	6.98×10^{12}	7.75×10^{11}	7.75×10^{12}	74
Cabin Creek	Headwaters Griffin to Towaliga River	5.69×10^{11}	3.29×10^{10}	3.66×10^{9}	6.06×10^{11}	72
Camp Creek	Headwaters to Jackson Creek	0	2.88×10^{12}	3.20×10^{11}	3.20×10^{12}	74
Cedar Creek	Headwaters to Alcovy River	0	1.55×10^{11}	1.72×10^{10}	1.72×10^{11}	52
Falling Creek	Little Falling Creek to Ocmulgee River	0	6.81×10^{11}	7.57×10^{10}	7.52×10^{11}	52
Hopkins Creek	Headwaters to Alcovy River	0	3.33×10^{11}	3.70×10^{10}	3.33×10^{11}	53
Jacks Creek	Headwaters to Yellow River	2.28×10^{11}	1.28×10^{12}	1.42×10^{11}	1.65×10^{12}	15
Jackson Creek	Gwinnett County	6.83×10^{11}	8.55×10^{12}	9.50×10^{11}	1.03×10^{13}	74
Little Haynes Creek	Hwy 20 to Big Haynes Creek	0	8.40×10^{11}	9.33×10^{10}	9.33×10^{11}	62
Little Stone Mountain Creek	Headwaters to Stone Mountain Lake	0	4.80×10^{11}	5.34×10^{10}	5.34×10^{11}	67
Little Suwanee Creek	Tributary to Yellow River	0	1.33×10^{12}	1.48×10^{11}	1.48×10^{12}	17
No Business Creek	Headwaters to Norris Lake	2.28×10^{11}	1.82×10^{12}	2.02×10^{11}	2.25×10^{12}	69
Pew Creek	Gwinnett County	0	1.22×10^{13}	1.35×10^{12}	1.35×10^{12}	12

Stream Name	Segment Description	WLAs (counts/30 days)	LAs (counts/30 days)	Margin of Safety	TMDL (counts/30 days)	Percent Reduction
Ocmulgee River	Beverdam Cr to Walnut Cr	6.83×10^{12}	7.60×10^{13}	8.44×10^{12}	9.13×10^{13}	87
Ocmulgee River	Tobesofkee Creek to Echeconnee Creek	1.14×10^{13}	8.52×10^{13}	9.47×10^{12}	1.06×10^{14}	91
Rocky Creek	1 mile u/s Rocky Creek Road to Tobesofkee Creek	5.46×10^{13}	3.56×10^{11}	3.96×10^{10}	5.50×10^{12}	93
Shetley Creek	Headwaters to Bromolow Creek	0	6.17×10^{11}	6.85×10^{10}	6.85×10^{11}	75
Shoal Creek	Headwaters to Alcovy River	0	7.31×10^{11}	8.13×10^{10}	8.13×10^{11}	73
Snapping Shoals Cr	Almand Branch to South R	2.84×10^{11}	1.41×10^{12}	1.56×10^{11}	1.85×10^{12}	75
South River	Atlanta to Flakes Mill Road	1.076×10^{13}	2.73×10^{13}	3.03×10^{12}	3.803×10^{13}	25 (see note 1)
South River	Flakes Mill Road to Pole Bridge Creek	1.54×10^{13}	3.90×10^{13}	4.33×10^{12}	5.87×10^{13}	25 (see note 1)
South River	Pole Bridge Creek to Hwy 20	1.54×10^{13}	6.39×10^{13}	7.10×10^{12}	8.64×10^{13}	50 (see note 1)
South River	Hwy 20 to Snapping Shoals Creek	1.78×10^{13}	1.18×10^{14}	1.31×10^{13}	1.49×10^{14}	35 (see note 1)
South River	Snapping Shoals Creek to Jackson Lake	1.78×10^{13}	1.18×10^{14}	1.31×10^{13}	1.49×10^{14}	35 (see note 1)
Stone Mountain Creek	Headwaters to Stone Mountain Lake	0	1.55×10^{12}	1.72×10^{11}	1.72×10^{12}	63
Sweetwater Creek	Lee Daniel Creek to Yellow River	1.70×10^{12}	1.52×10^{13}	1.68×10^{12}	1.85×10^{13}	79
Swift Creek	Headwaters to Yellow River	0	7.17×10^{11}	7.96×10^{10}	7.96×10^{11}	71
Tobesofkee Creek (3 segments)	Cole Creek to Rocky Creek	2.69×10^{11}	2.82×10^{11}	3.13×10^{10}	5.82×10^{11}	88
Town Branch	Downstream Jackson South WPCP to Aboothlacoosta Creek	1.59×10^{11}	1.05×10^{11}	1.05×10^{10}	2.75×10^{11}	97
Turkey Creek	Headwaters to Yellow River	0	6.57×10^{11}	7.30×10^{10}	7.30×10^{11}	70
Tussahaw Creek	Wolf Creek to Lake Jackson	5.69×10^{10}	3.30×10^{14}	3.67×10^{13}	3.67×10^{14}	71
Walnut Creek	Headwaters to Ocmulgee River	0	3.62×10^{11}	4.02×10^{10}	4.02×10^{11}	99

Stream Name	Segment Description	WLAs (counts/30 days)	LAs (counts/30 days)	Margin of Safety	TMDL (counts/30 days)	Percent Reduction
Watson Creek	Headwaters to Yellow River	0	9.62×10^{11}	1.07×10^{11}	1.07×10^{12}	70
Wise Creek	Headwaters to Ocmulgee River	0	1.61×10^{11}	1.79×10^{10}	1.79×10^{11}	78
Yellow River	Big Haynes Creek to Jackson Lake	3.00×10^{12}	7.16×10^{13}	7.95×10^{12}	8.25×10^{13}	64
Yellow River	Hwy 124 to Big Haynes Creek	2.50×10^{12}	5.65×10^{13}	6.28×10^{12}	6.53×10^{13}	64
Yellow River	Sweetwater Creek to Hwy 124	2.27×10^{12}	4.51×10^{13}	5.01×10^{12}	5.23×10^{13}	65
Yellow Water Creek	1 mile d/s Stark Road	2.05×10^{11}	7.13×10^{10}	7.92×10^{9}	2.84×10^{11}	86

NOTES:
1. TMDLs for South River require 98 percent reduction from CSOs as prescribed in TMDLs developed by EPD for Intrenchment Creek and North Branch South River (EPD, 2002).

Table 10. Management Measure Selector Table

Land Use	**Management Measures**	Fecal Coliform	Dissolved Oxygen	pH	Sediment	Temperature	*Toxicity*	*Mercury*	Metals (copper, lead, zinc, cadmium)	PCBs, toxaphene
Agriculture	1. Sediment & Erosion Control	_	_		_	_				
	2. Confined Animal Facilities	_	_							
	3. Nutrient Management	_	_							
	4. Pesticide Management		_							
	5. Livestock Grazing	_	_		_	_				
	6. Irrigation		_		_	_				
Forestry	1. Preharvest Planning				_	_				
	2. Streamside Management Areas	_	_		_	_				
	3. Road Construction &Reconstruction		_		_	_				
	4. Road Management		_		_	_				
	5. Timber Harvesting		_		_	_				
	6. Site Preparation & Forest Regeneration		–		–	–				
	7. Fire Management	_	_	_	_	_				
	8. Revegetation of Disturbed Areas	_	_	_	_	_				
	9. Forest Chemical Management		_			_				
	10. Wetlands Forest Management	_	_	_		_		_		
Urban	1. New Development	_	_		_	_			_	
	2. Watershed Protection & Site Development.	–	–		–	–		–	–	

Land Use	**Management Measures**	Fecal Coliform	Dissolved Oxygen	pH	Sediment	Temperature	*Toxicity*	*Mercury*	Metals (copper, lead, zinc, cadmium)	PCBs, toxaphene
	3. Construction Site Erosion and Sediment Control		–		–	–				
	4. Construction Site Chemical Control		–							
	5. Existing Developments	–	–		–	–			–	
	6. Residential and Commercial Pollution Prevention	–	–							
Onsite Wastewater	1. New Onsite Wastewater Disposal Systems	–	–							
	2. Operating Existing Onsite Wastewater Disposal Systems	–	–							
Roads, Highways and Bridges	1. Siting New Roads, Highways & Bridges	–	–		–	–			–	
	2. Construction Projects for Roads, Highways and Bridges		–		–	–				
	3. Construction Site Chemical Control for Roads, Highways and Bridges		–							
	4. Operation and Maintenance- Roads, Highways and Bridges	–	–			–			–	

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APPENDIX A:

HYDROLOGY CALIBRATIONS

Table A1 - Calibration and Validation Stations for Hydrological Parameters Above the GA Fall Line (Piedmont)

Station Number	Station Name	Type	Drainage Area (acres)	Reference WDM station
02204070	South River at Klondike Road	Calibration	117978	Atlanta Hartsfield
02219000	Apalachee River near Bostwick, GA	Validation	119738	Monroe
02217500	Middle Oconee River near Athens, GA	Validation	252006	Jefferson
02220900	Little River near Eatonton, GA	Validation	174445	Milledgeville
02221525	Murder Creek Below Eatonton, GA	Validation	121690	Milledgeville
02208450	Alcovy River above Covington, GA	Validation	122720	Monroe
02213000	Ocmulgee River at Macon, GA	Validation	1450880	Macon Lewis

Figure A.1. Location of Hydrology Calibration and Validation Stations

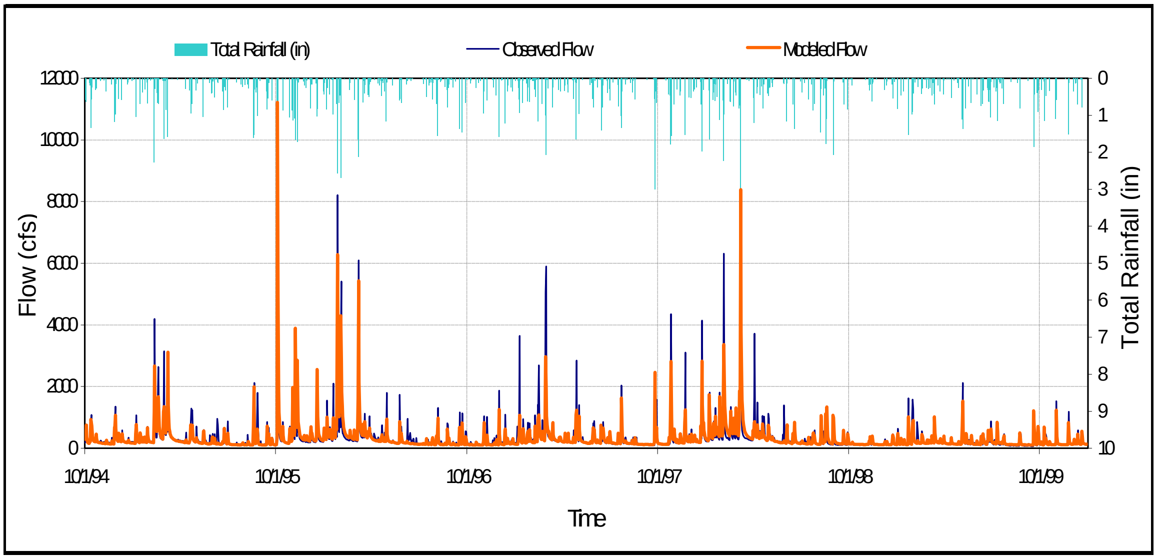

Figure A.2. 5.2-Year Calibration (Daily Flow) at 02204070 – South River at Klondike Road.

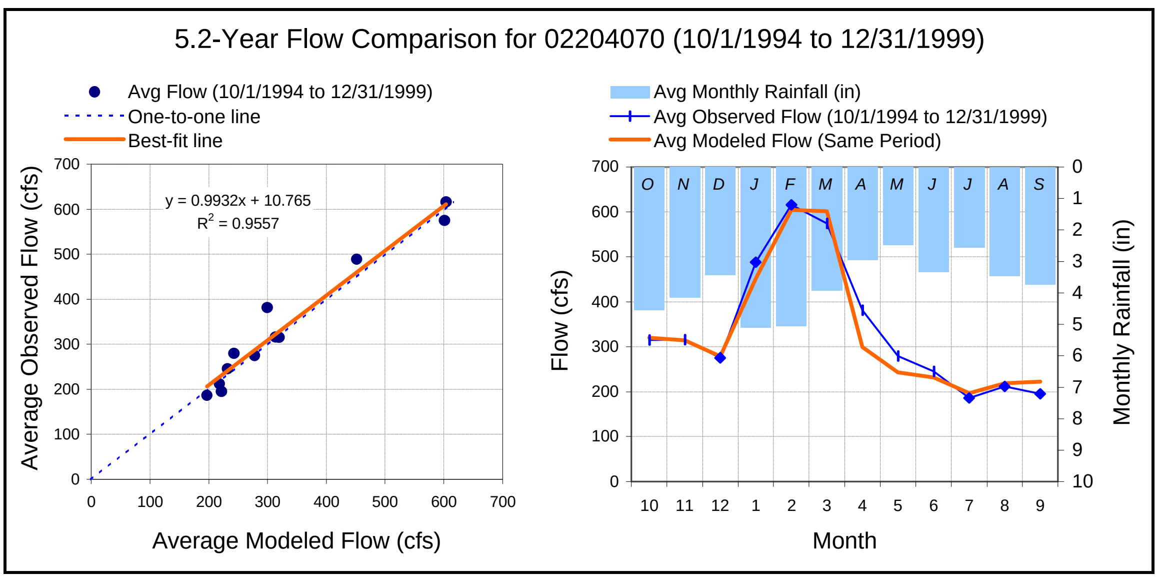

Figure A.3. 5.2-Year Calibration (Monthly Average) at 02204070 – South River at Klondike Road.

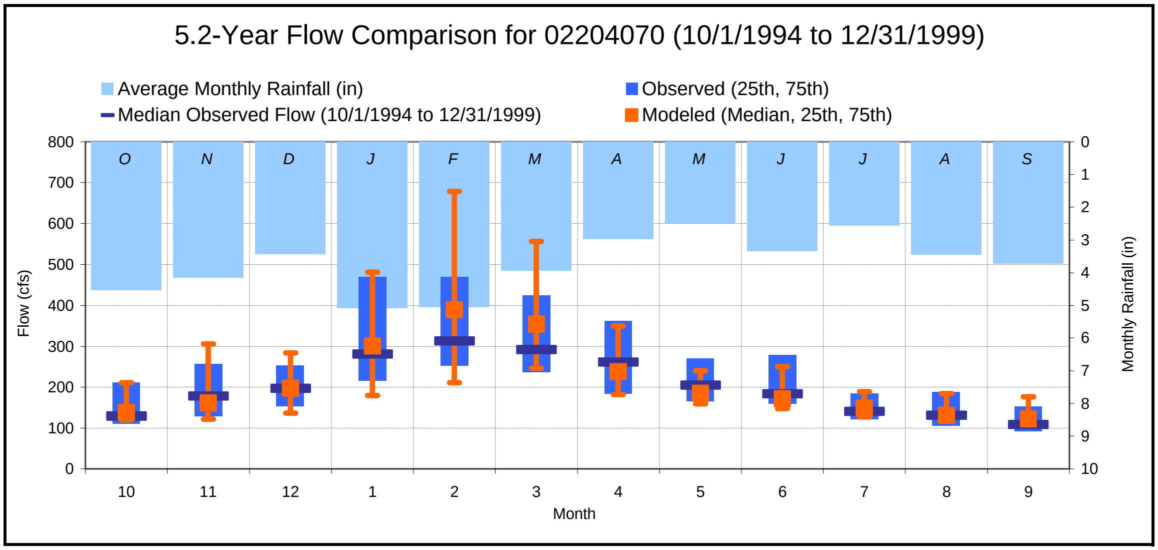

Figure A.4. 5.2-Year Calibration (Monthly Medians) at 02204070 – South River at Klondike Road.

Simulation Name:	02204070	**Simulation Period:**	
		Watershed Area (ac):	117978
Period for Flow Analysis			
Begin Date:	**10/01/94**	**Baseflow PERCENTILE:**	2.5
End Date:	**12/31/99**	*Usually 1%-5%*	
Total Simulated In-stream Flow:	**127.39**	Total Observed In-stream Flow:	**130.44**
Total of highest 10% flows:	**50.64**	Total of Observed highest 10% flows:	**58.20**
Total of lowest 50% flows:	**27.00**	Total of Observed Lowest 50% flows:	**26.39**
Simulated Summer Flow Volume (months 7-9):	**19.70**	Observed Summer Flow Volume (7-9):	**18.35**
Simulated Fall Flow Volume (months 10-12):	**33.85**	Observed Fall Flow Volume (10-12):	**33.63**
Simulated Winter Flow Volume (months 1-3):	**50.13**	Observed Winter Flow Volume (1-3):	**50.76**
Simulated Spring Flow Volume (months 4-6):	**23.70**	Observed Spring Flow Volume (4-6):	**27.71**
Total Simulated Storm Volume:	**85.31**	Total Observed Storm Volume:	**98.06**
Simulated Summer Storm Volume (7-9):	**9.62**	Observed Summer Storm Volume (7-9):	**10.67**
Errors (Simulated-Observed)		*Recommended Criteria*	Last run
Error in total volume:	**-2.40**	10	
Error in 50% lowest flows:	**2.25**	10	
Error in 10% highest flows:	**-14.92**	15	
Seasonal volume error - Summer:	**6.87**	30	
Seasonal volume error - Fall:	**0.65**	30	
Seasonal volume error - Winter:	**-1.24**	30	
Seasonal volume error - Spring:	**-16.90**	30	
Error in storm volumes:	**-14.94**	20	
Error in summer storm volumes:	**-10.85**	50	

Figure A.5. 5.2-Year Calibration Statistics at 02204070 – South River at Klondike Road.

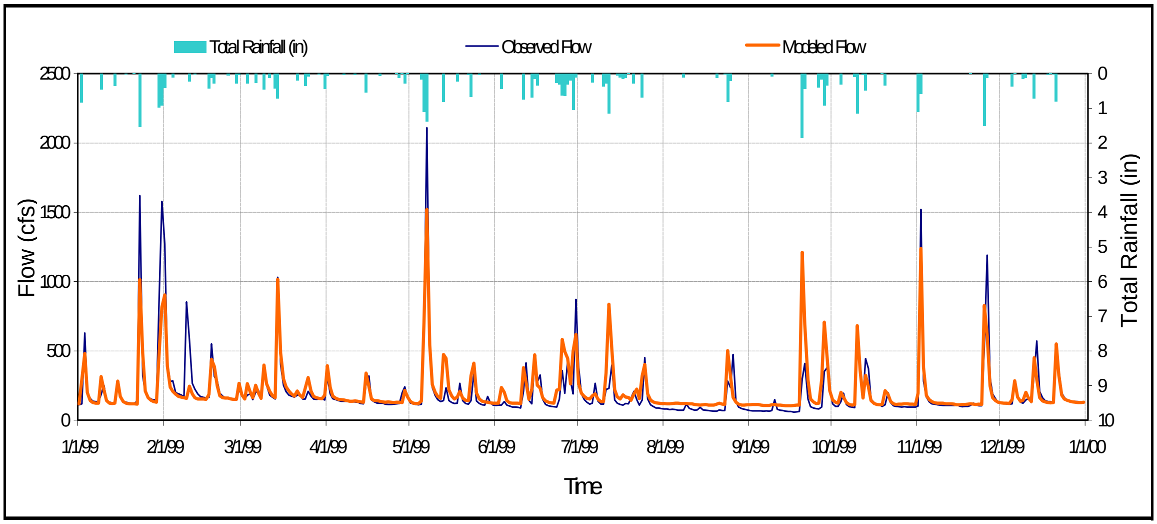

Figure A.6. Calendar Year 1999 (Daily Flow) at 02204070 – South River at Klondike Road.

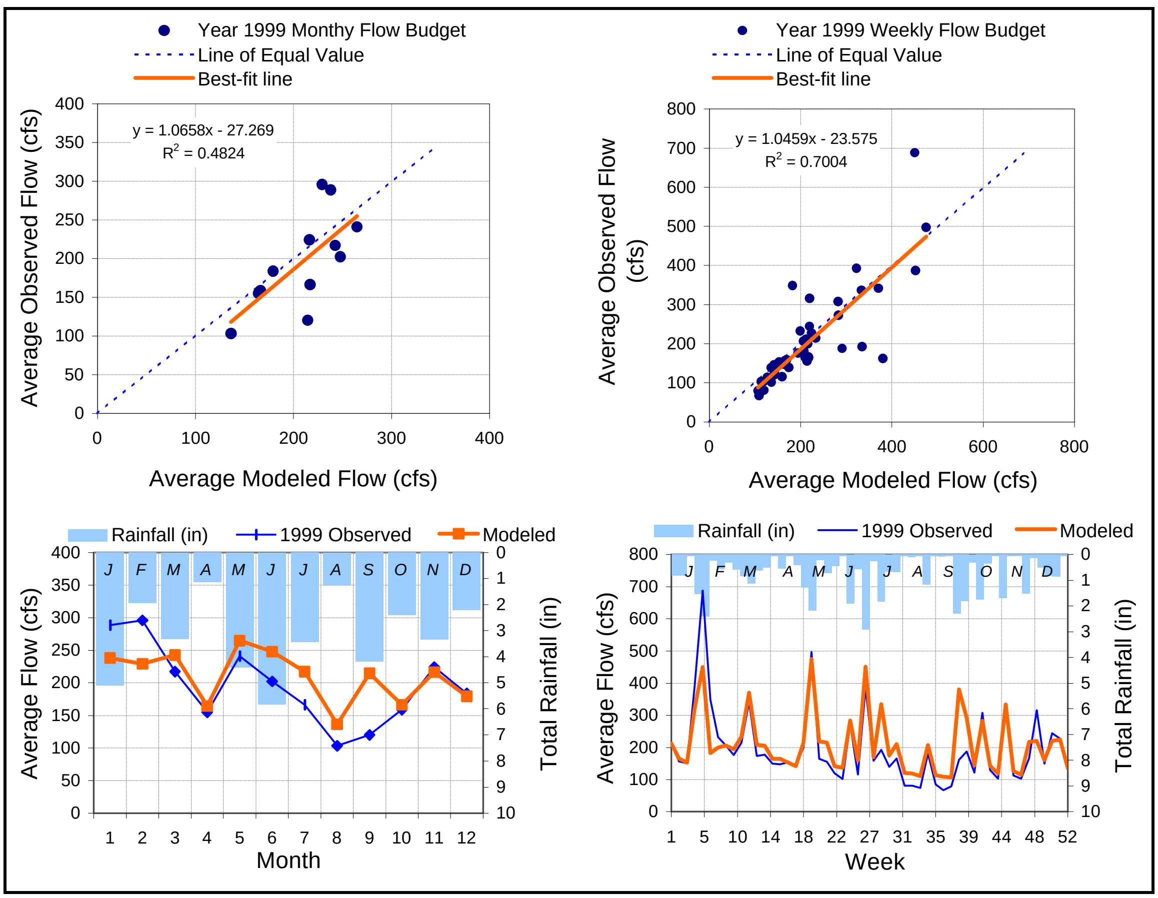

Figure A.7. Calendar Year 1999 (Monthly and Weekly) at 02204070 – South River at Klondike Road.

Simulation Name:	02204070	**Simulation Period:**	
		Watershed Area (ac):	117978
Selected a Year for Flow Analysis:	**1999**		
Type of Year (1=Calendar, 2=Water Year)	**1**	**Baseflow PERCENTILE:**	2.5
Calendar Year 1999:		*Usually 1%-5%*	
1/1/1999 to 12/31/1999			
Total Simulated In-stream Flow:	**15.43**	Total Observed In-stream Flow:	**14.41**
Total of highest 10% flows:	**4.80**	Total of Observed highest 10% flows:	**5.09**
Total of lowest 50% flows:	**4.55**	Total of Observed Lowest 50% flows:	**3.79**
Simulated Summer Flow Volume (months 7-9):	**3.51**	Observed Summer Flow Volume (7-9):	**2.41**
Simulated Fall Flow Volume (months 10-12):	**3.47**	Observed Fall Flow Volume (10-12):	**3.50**
Simulated Winter Flow Volume (months 1-3):	**4.30**	Observed Winter Flow Volume (1-3):	**4.83**
Simulated Spring Flow Volume (months 4-6):	**4.15**	Observed Spring Flow Volume (4-6):	**3.67**
Total Simulated Storm Volume:	**7.54**	Total Observed Storm Volume:	**9.61**
Simulated Summer Storm Volume (7-9):	**1.52**	Observed Summer Storm Volume (7-9):	**1.21**
Errors (Simulated-Observed)		*Recommended Criteria*	Last run
Error in total volume:	**6.63**	10	
Error in 50% lowest flows:	**16.82**	10	
Error in 10% highest flows:	**-6.11**	15	
Seasonal volume error - Summer:	**31.30**	30	
Seasonal volume error - Fall:	**-0.75**	30	
Seasonal volume error - Winter:	**-12.36**	30	
Seasonal volume error - Spring:	**11.63**	30	
Error in storm volumes:	**-27.51**	20	
Error in summer storm volumes:	**20.76**	50	

Figure A.8. Calendar Year 1999 Statistics at 02204070 – South River at Klondike Road.

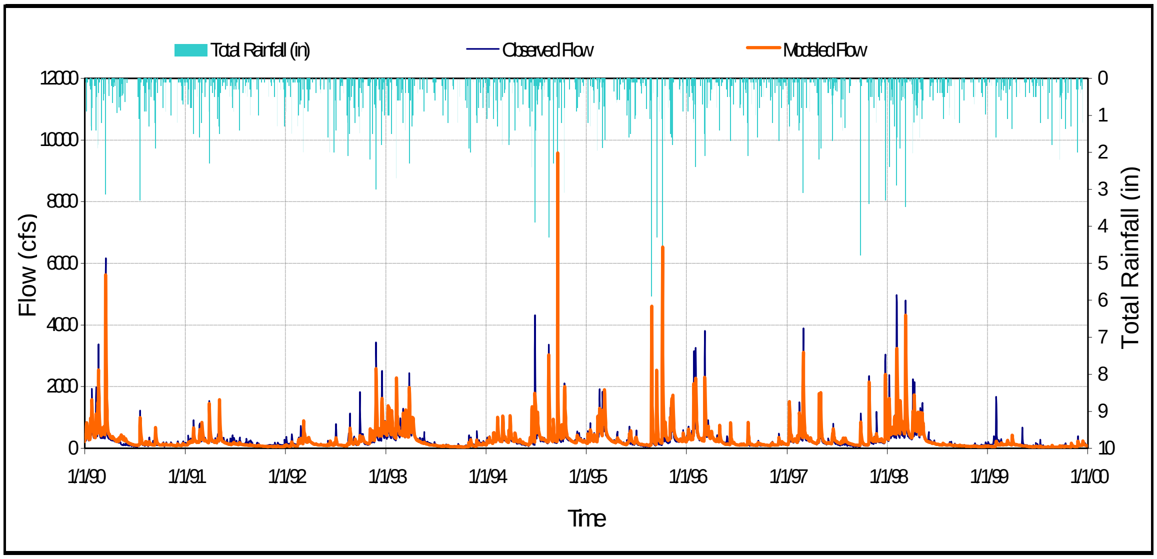

Figure A.9. 10-Year Validation (Daily Flow) at 02219000 – Apalachee River near Bostwick, GA.

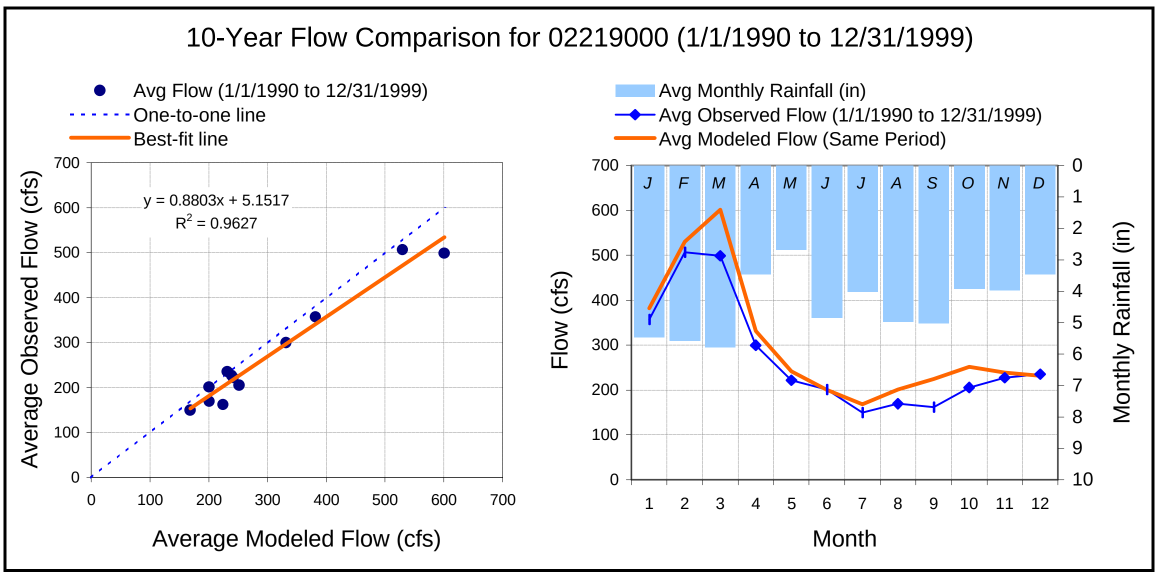

Figure A.10. 10-Year Validation (Monthly Average) at 02219000 – Apalachee River near Bostwick, GA.

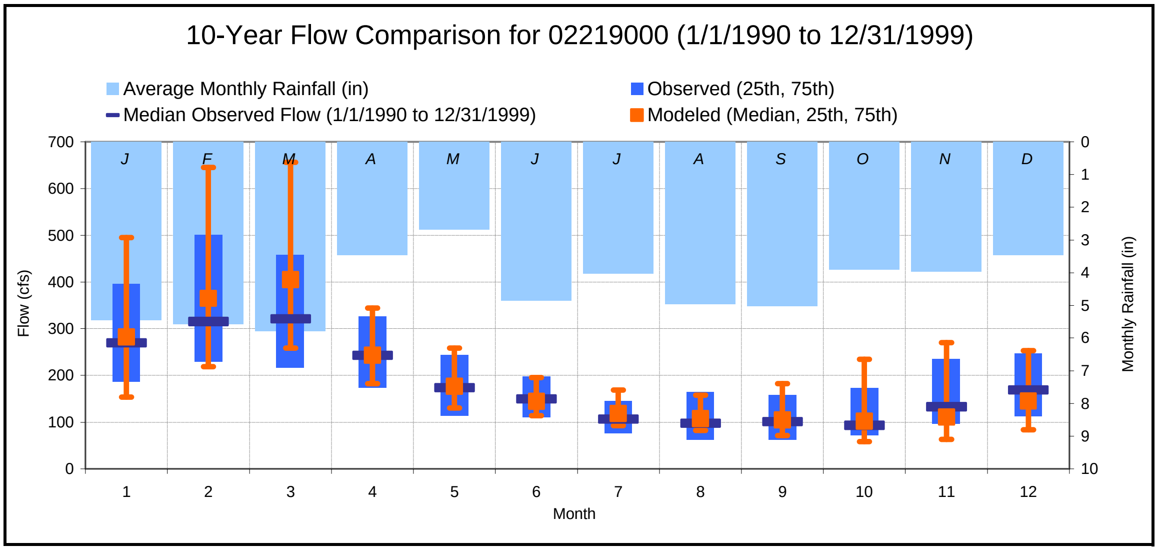

Figure A.11. 10-Year Validation (Monthly Medians) at 02219000 – Apalachee River near Bostwick, GA.

Simulation Name:	02219000	**Simulation Period:**	
		Watershed Area (ac):	119738
Period for Flow Analysis			
Begin Date:	**01/01/90**	**Baseflow PERCENTILE:**	2.5
End Date:	**12/31/99**	*Usually 1%-5%*	
Total Simulated In-stream Flow:	**217.08**	Total Observed In-stream Flow:	**194.66**
Total of highest 10% flows:	**90.29**	Total of Observed highest 10% flows:	**78.55**
Total of lowest 50% flows:	**35.38**	Total of Observed Lowest 50% flows:	**37.57**
Simulated Summer Flow Volume (months 7-9):	**36.16**	Observed Summer Flow Volume (7-9):	**29.31**
Simulated Fall Flow Volume (months 10-12):	**44.03**	Observed Fall Flow Volume (10-12):	**40.69**
Simulated Winter Flow Volume (months 1-3):	**90.27**	Observed Winter Flow Volume (1-3):	**81.15**
Simulated Spring Flow Volume (months 4-6):	**46.62**	Observed Spring Flow Volume (4-6):	**43.51**
Total Simulated Storm Volume:	**185.93**	Total Observed Storm Volume:	**162.94**
Simulated Summer Storm Volume (7-9):	**28.43**	Observed Summer Storm Volume (7-9):	**21.48**
Errors (Simulated-Observed)		*Recommended Criteria*	Last run
Error in total volume:	**10.33**	10	
Error in 50% lowest flows:	**-6.21**	10	
Error in 10% highest flows:	**13.01**	15	
Seasonal volume error - Summer:	**18.93**	30	
Seasonal volume error - Fall:	**7.60**	30	
Seasonal volume error - Winter:	**10.10**	30	
Seasonal volume error - Spring:	**6.66**	30	
Error in storm volumes:	**12.36**	20	
Error in summer storm volumes:	**24.43**	50	

Figure A.12. 10-Year Validation Statistics at 02219000 – Apalachee River near Bostwick, GA.

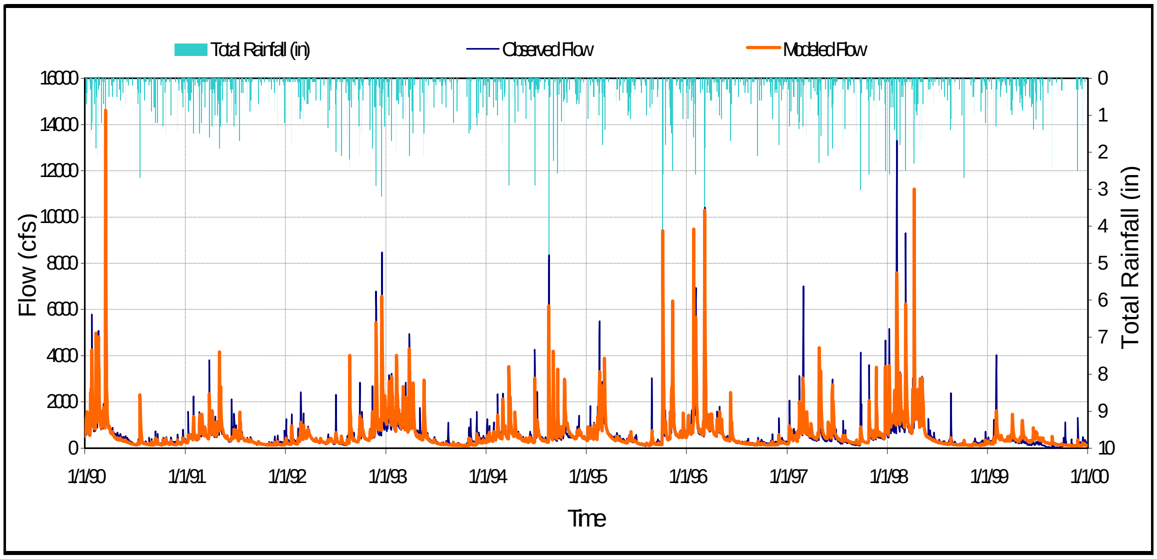

Figure A.13. 10-Year Validation (Daily Flow) at 02217500 – Middle Oconee River near Athens, GA.

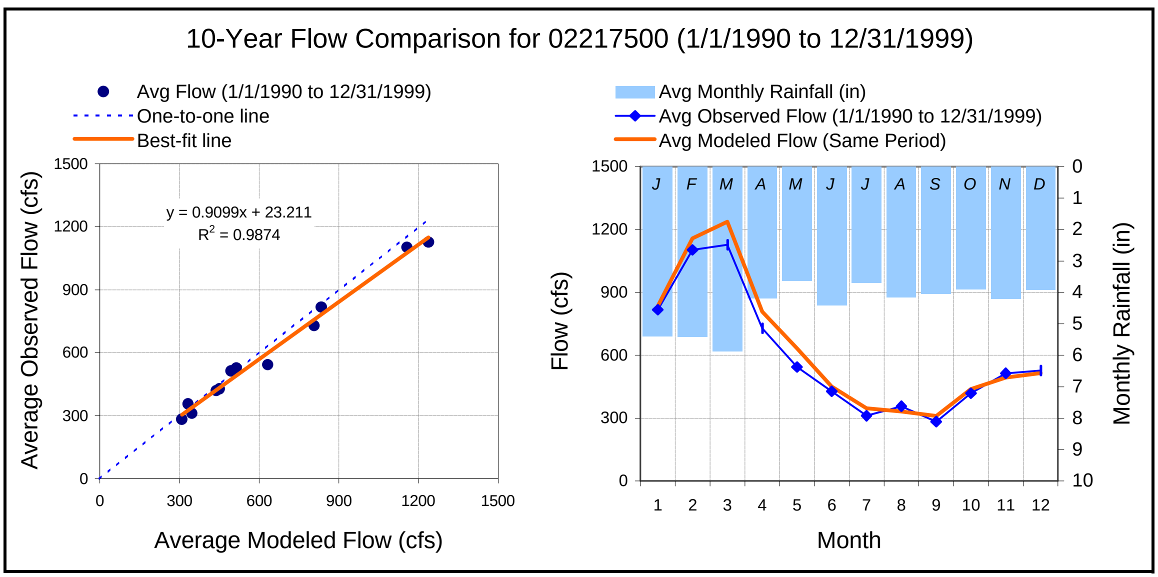

Figure A.14. 10-Year Validation (Monthly Average) at 02217500 – Middle Oconee River near Athens, GA.

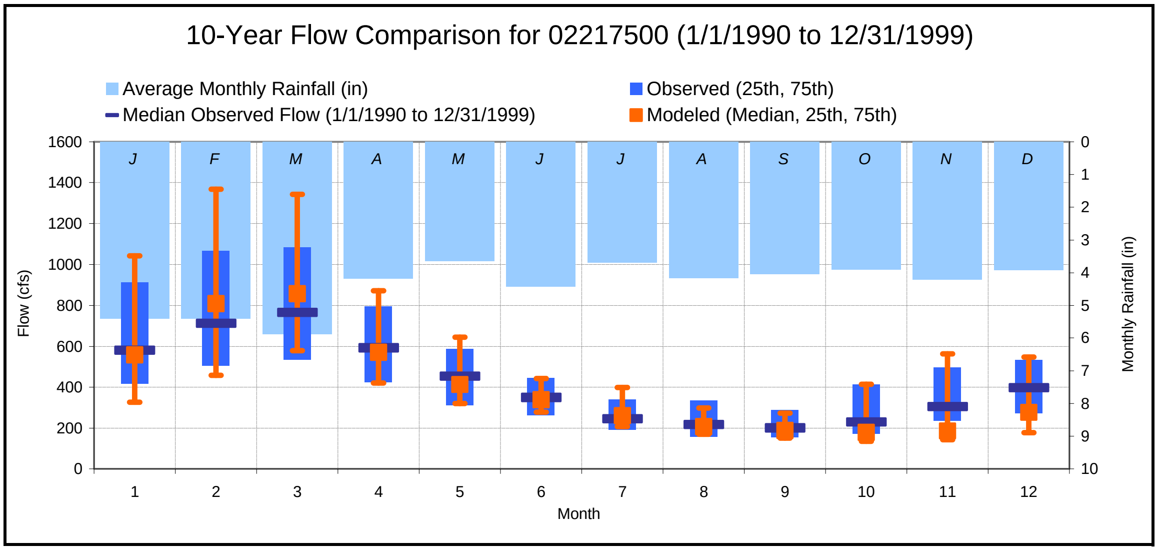

Figure A.15. 10-Year Validation (Monthly Medians) at 02217500 – Middle Oconee River near Athens, GA.

Simulation Name:	02217500	**Simulation Period:**	
		Watershed Area (ac):	252006
Period for Flow Analysis			
Begin Date:	**01/01/90**	**Baseflow PERCENTILE:**	2.5
End Date:	**12/31/99**	*Usually 1%-5%*	
Total Simulated In-stream Flow:	**216.24**	Total Observed In-stream Flow:	**204.71**
Total of highest 10% flows:	**86.28**	Total of Observed highest 10% flows:	**78.78**
Total of lowest 50% flows:	**38.25**	Total of Observed Lowest 50% flows:	**41.80**
Simulated Summer Flow Volume (months 7-9):	**28.67**	Observed Summer Flow Volume (7-9):	**27.55**
Simulated Fall Flow Volume (months 10-12):	**41.92**	Observed Fall Flow Volume (10-12):	**42.23**
Simulated Winter Flow Volume (months 1-3):	**91.48**	Observed Winter Flow Volume (1-3):	**86.27**
Simulated Spring Flow Volume (months 4-6):	**54.17**	Observed Spring Flow Volume (4-6):	**48.65**
Total Simulated Storm Volume:	**175.96**	Total Observed Storm Volume:	**167.18**
Simulated Summer Storm Volume (7-9):	**18.50**	Observed Summer Storm Volume (7-9):	**18.39**
Errors (Simulated-Observed)		*Recommended Criteria*	Last run
Error in total volume:	**5.33**	10	
Error in 50% lowest flows:	**-9.30**	10	
Error in 10% highest flows:	**8.69**	15	
Seasonal volume error - Summer:	**3.89**	30	
Seasonal volume error - Fall:	**-0.74**	30	
Seasonal volume error - Winter:	**5.69**	30	
Seasonal volume error - Spring:	**10.19**	30	
Error in storm volumes:	**4.99**	20	
Error in summer storm volumes:	**0.61**	50	

Figure A.16. 10-Year Validation Statistics at 02217500 – Middle Oconee River near Athens, GA.

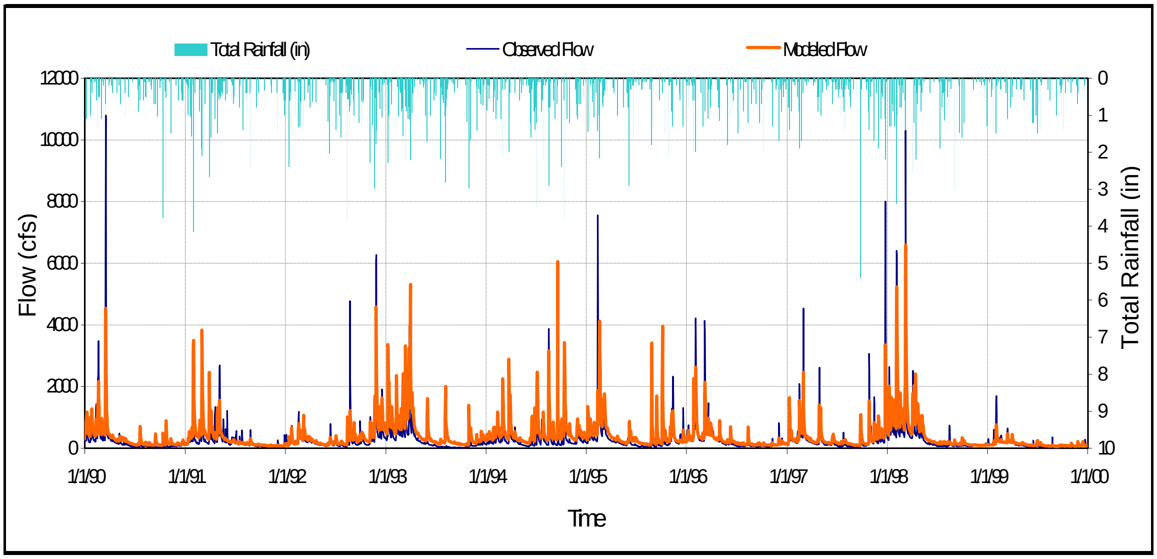

Figure A.17. 10-Year Validation (Daily Flow) at 02220900 – Little River near Eatonton, GA.

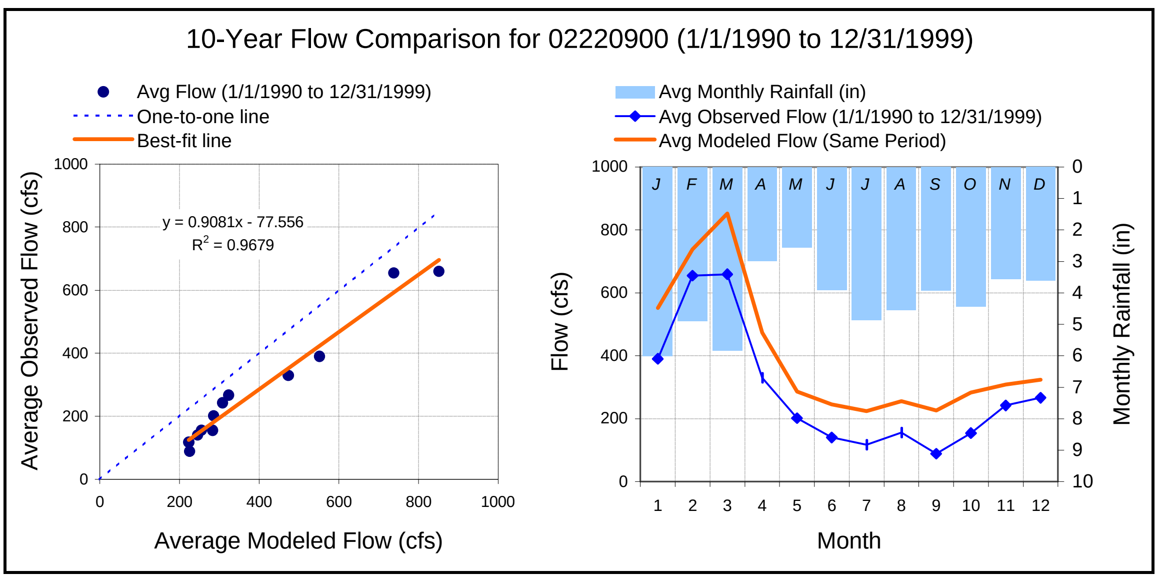

Figure A.18. 10-Year Validation (Monthly Average) at 02220900 – Little River near Eatonton, GA.

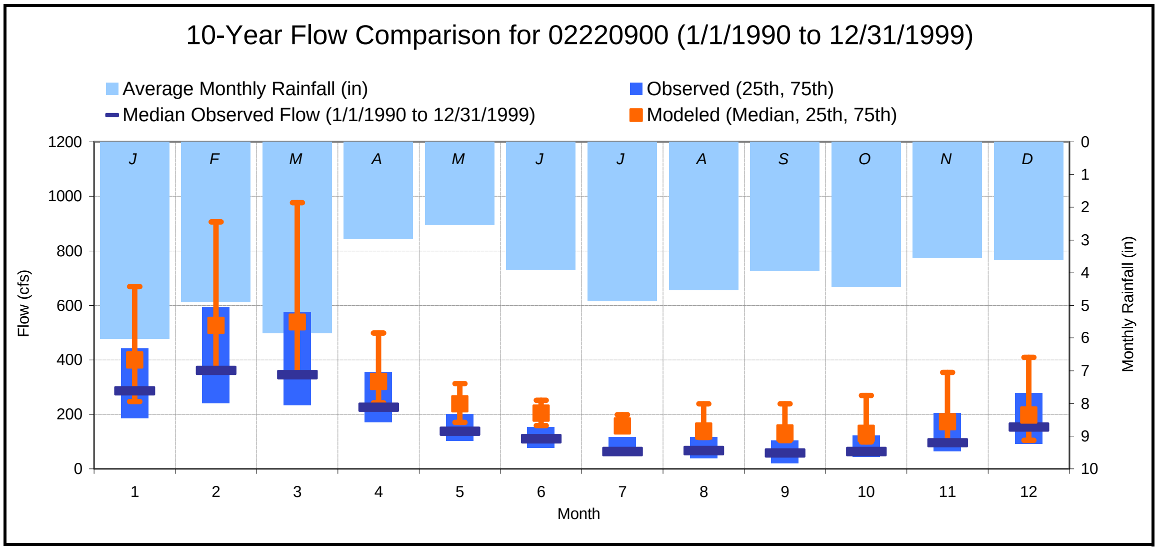

Figure A.19. 10-Year Validation (Monthly Medians) at 02220900 – Little River near Eatonton, GA.

Simulation Name:	02220900	**Simulation Period:**	
		Watershed Area (ac):	174445
Period for Flow Analysis			
Begin Date:	**01/01/90**	**Baseflow PERCENTILE:**	2.5
End Date:	**12/31/99**	*Usually 1%-5%*	
Total Simulated In-stream Flow:	**197.17**	Total Observed In-stream Flow:	**140.21**
Total of highest 10% flows:	**77.93**	Total of Observed highest 10% flows:	**67.14**
Total of lowest 50% flows:	**34.87**	Total of Observed Lowest 50% flows:	**18.88**
Simulated Summer Flow Volume (months 7-9):	**29.53**	Observed Summer Flow Volume (7-9):	**15.17**
Simulated Fall Flow Volume (months 10-12):	**38.32**	Observed Fall Flow Volume (10-12):	**27.72**
Simulated Winter Flow Volume (months 1-3):	**87.78**	Observed Winter Flow Volume (1-3):	**69.58**
Simulated Spring Flow Volume (months 4-6):	**41.54**	Observed Spring Flow Volume (4-6):	**27.75**
Total Simulated Storm Volume:	**162.94**	Total Observed Storm Volume:	**131.80**
Simulated Summer Storm Volume (7-9):	**20.93**	Observed Summer Storm Volume (7-9):	**13.08**
Errors (Simulated-Observed)		*Recommended Criteria*	Last run
Error in total volume:	**28.89**	10	
Error in 50% lowest flows:	**45.86**	10	
Error in 10% highest flows:	**13.84**	15	
Seasonal volume error - Summer:	**48.64**	30	
Seasonal volume error - Fall:	**27.66**	30	
Seasonal volume error - Winter:	**20.74**	30	
Seasonal volume error - Spring:	**33.20**	30	
Error in storm volumes:	**19.11**	20	
Error in summer storm volumes:	**37.52**	50	

Figure A.20. 10-Year Validation Statistics at 02220900 – Little River near Eatonton, GA.

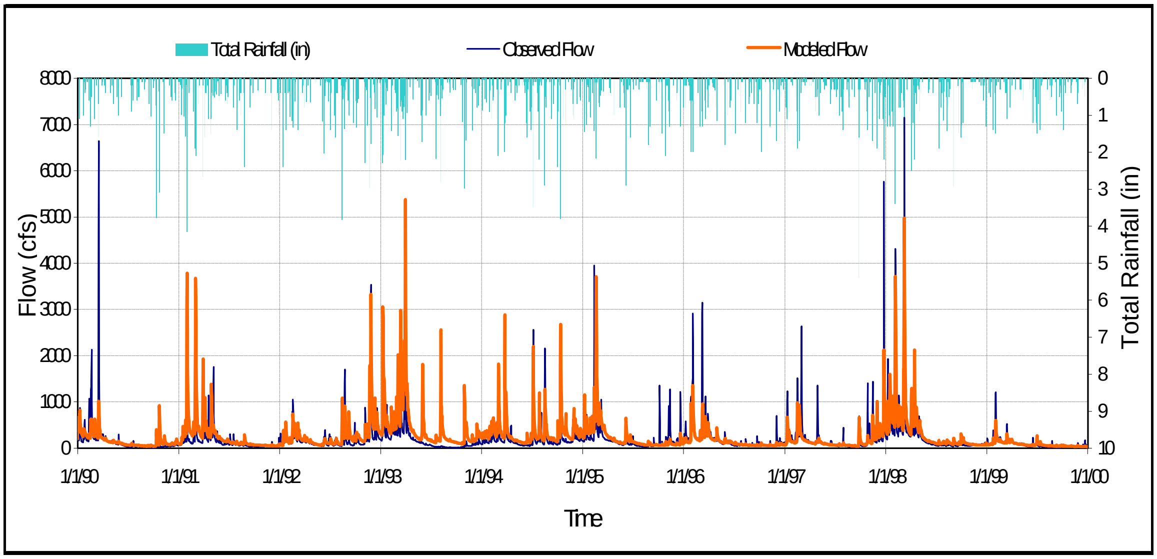

Figure A.21. 10-Year Validation (Daily Flow) at 02221525 – Murder Creek below Eatonton, GA.

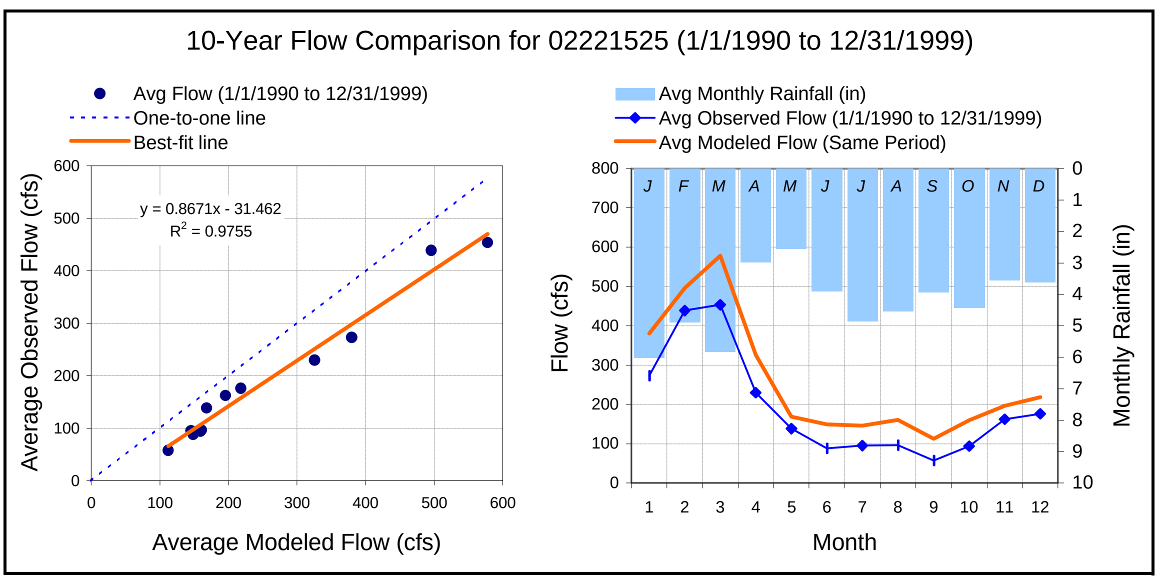

Figure A.22. 10-Year Validation (Monthly Average) at 02221525 – Murder Creek below Eatonton, GA.

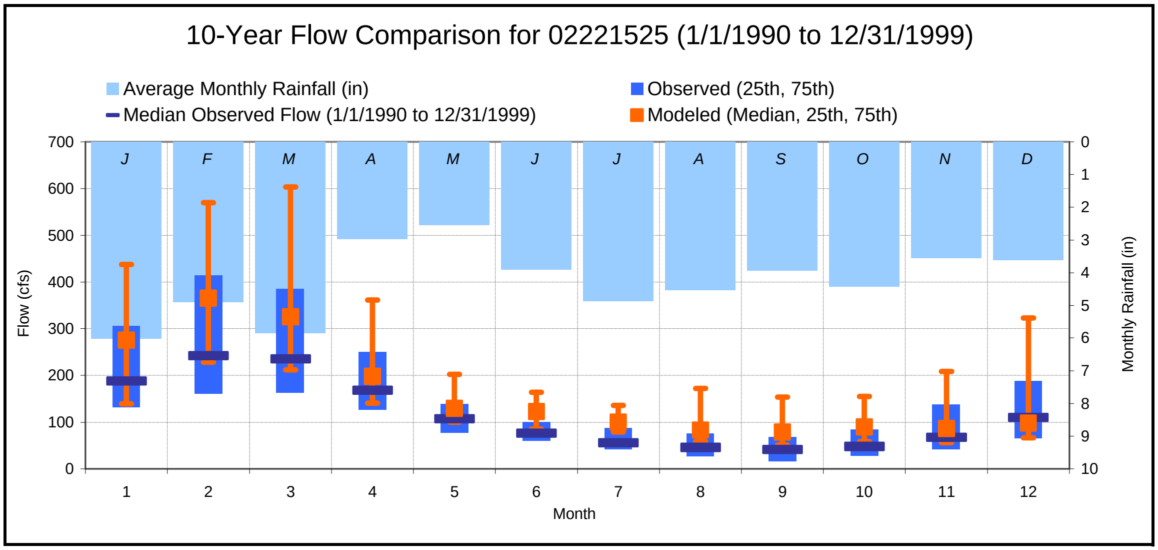

Figure A.23. 10-Year Validation (Monthly Medians) at 02221525 – Murder Creek below Eatonton, GA.

Simulation Name:	02221525	**Simulation Period:**	
		Watershed Area (ac):	121690
Period for Flow Analysis			
Begin Date:	**01/01/90**	**Baseflow PERCENTILE:**	2.5
End Date:	**12/31/99**	*Usually 1%-5%*	
Total Simulated In-stream Flow:	**183.13**	Total Observed In-stream Flow:	**136.13**
Total of highest 10% flows:	**77.13**	Total of Observed highest 10% flows:	**65.23**
Total of lowest 50% flows:	**29.68**	Total of Observed Lowest 50% flows:	**19.42**
Simulated Summer Flow Volume (months 7-9):	**25.17**	Observed Summer Flow Volume (7-9):	**14.98**
Simulated Fall Flow Volume (months 10-12):	**34.40**	Observed Fall Flow Volume (10-12):	**25.89**
Simulated Winter Flow Volume (months 1-3):	**85.48**	Observed Winter Flow Volume (1-3):	**68.24**
Simulated Spring Flow Volume (months 4-6):	**38.09**	Observed Spring Flow Volume (4-6):	**27.02**
Total Simulated Storm Volume:	**154.89**	Total Observed Storm Volume:	**126.19**
Simulated Summer Storm Volume (7-9):	**18.04**	Observed Summer Storm Volume (7-9):	**12.51**
Errors (Simulated-Observed)		*Recommended Criteria*	Last run
Error in total volume:	**25.67**	10	
Error in 50% lowest flows:	**34.59**	10	
Error in 10% highest flows:	**15.43**	15	
Seasonal volume error - Summer:	**40.47**	30	
Seasonal volume error - Fall:	**24.73**	30	
Seasonal volume error - Winter:	**20.17**	30	
Seasonal volume error - Spring:	**29.06**	30	
Error in storm volumes:	**18.52**	20	
Error in summer storm volumes:	**30.66**	50	

Figure A.24. 10-Year Validation Statistics at 02221525 – Murder Creek below Eatonton, GA.

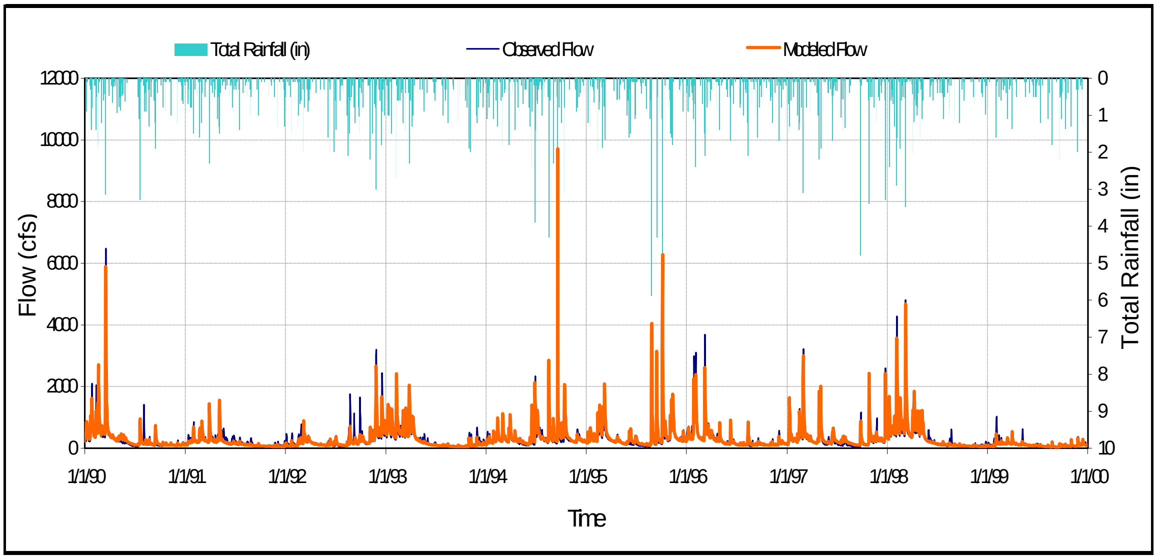

Figure A.25. 10-Year Validation (Daily Flow) at 02208450 – Alcovy River above Covington, GA.

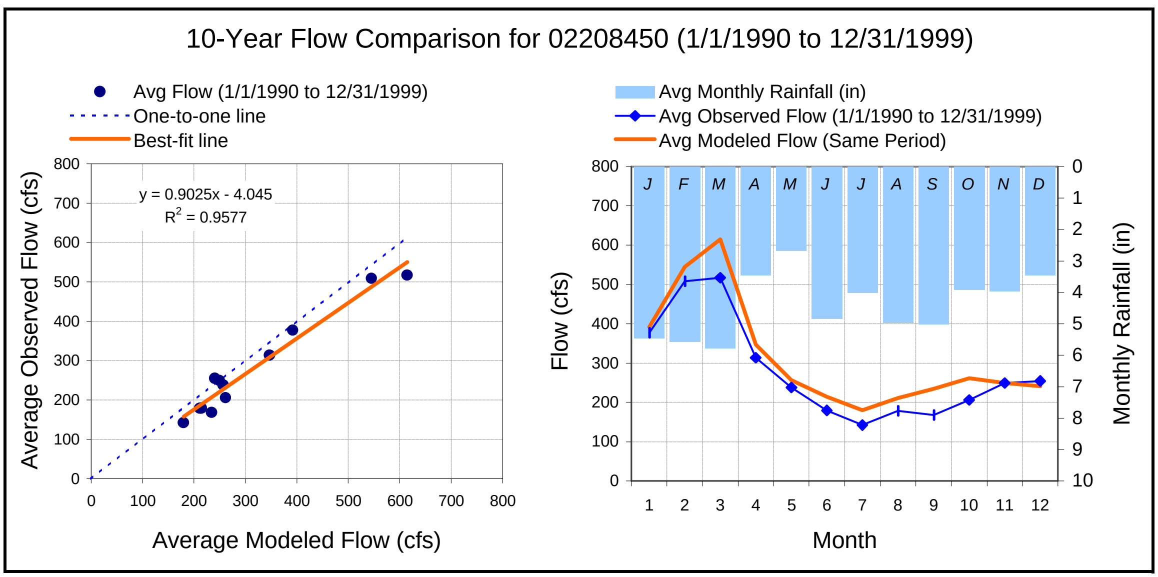

Figure A.26. 10-Year Validation (Monthly Average) at 02208450 – Alcovy River above Covington, GA.

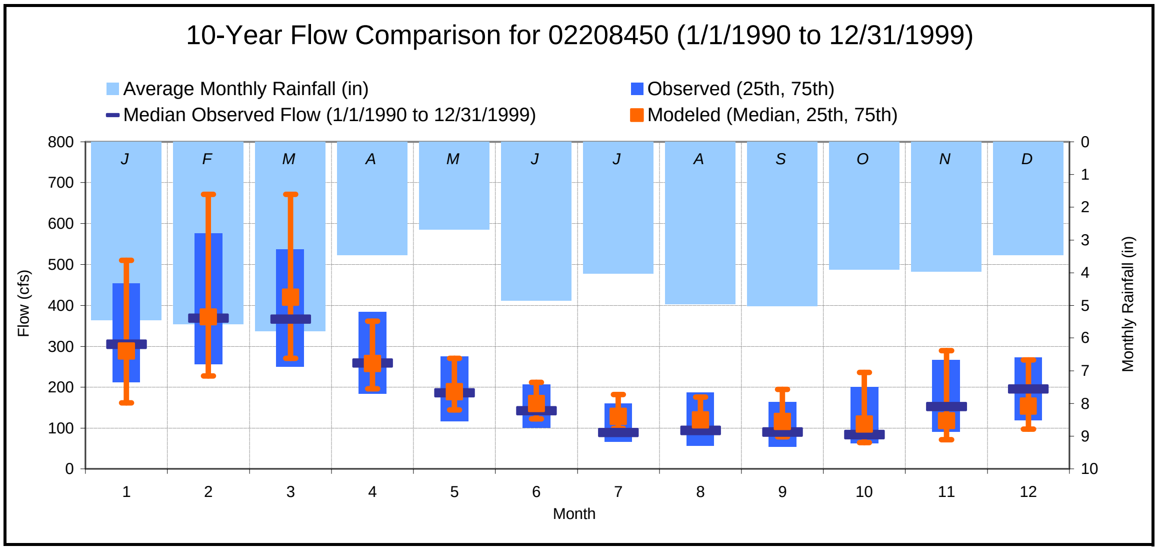

Figure A.27. 10-Year Validation (Monthly Medians) at 02208450 – Alcovy River above Covington, GA.

Simulation Name:	02208450	**Simulation Period:**	
		Watershed Area (ac):	122720
Period for Flow Analysis			
Begin Date:	**01/01/90**	**Baseflow PERCENTILE:**	2.5
End Date:	**12/31/99**	*Usually 1%-5%*	
Total Simulated In-stream Flow:	**220.25**	Total Observed In-stream Flow:	**195.82**
Total of highest 10% flows:	**89.19**	Total of Observed highest 10% flows:	**72.34**
Total of lowest 50% flows:	**38.46**	Total of Observed Lowest 50% flows:	**35.50**
Simulated Summer Flow Volume (months 7-9):	**37.13**	Observed Summer Flow Volume (7-9):	**29.05**
Simulated Fall Flow Volume (months 10-12):	**44.68**	Observed Fall Flow Volume (10-12):	**42.19**
Simulated Winter Flow Volume (months 1-3):	**90.33**	Observed Winter Flow Volume (1-3):	**81.59**
Simulated Spring Flow Volume (months 4-6):	**48.11**	Observed Spring Flow Volume (4-6):	**42.99**
Total Simulated Storm Volume:	**184.55**	Total Observed Storm Volume:	**171.05**
Simulated Summer Storm Volume (7-9):	**28.18**	Observed Summer Storm Volume (7-9):	**22.97**
Errors (Simulated-Observed)		*Recommended Criteria*	Last run
Error in total volume:	**11.09**	10	
Error in 50% lowest flows:	**7.69**	10	
Error in 10% highest flows:	**18.90**	15	
Seasonal volume error - Summer:	**21.75**	30	
Seasonal volume error - Fall:	**5.57**	30	
Seasonal volume error - Winter:	**9.68**	30	
Seasonal volume error - Spring:	**10.64**	30	
Error in storm volumes:	**7.31**	20	
Error in summer storm volumes:	**18.49**	50	

Figure A.28. 10-Year Validation Statistics at 02208450 – Alcovy River above Covington, GA.

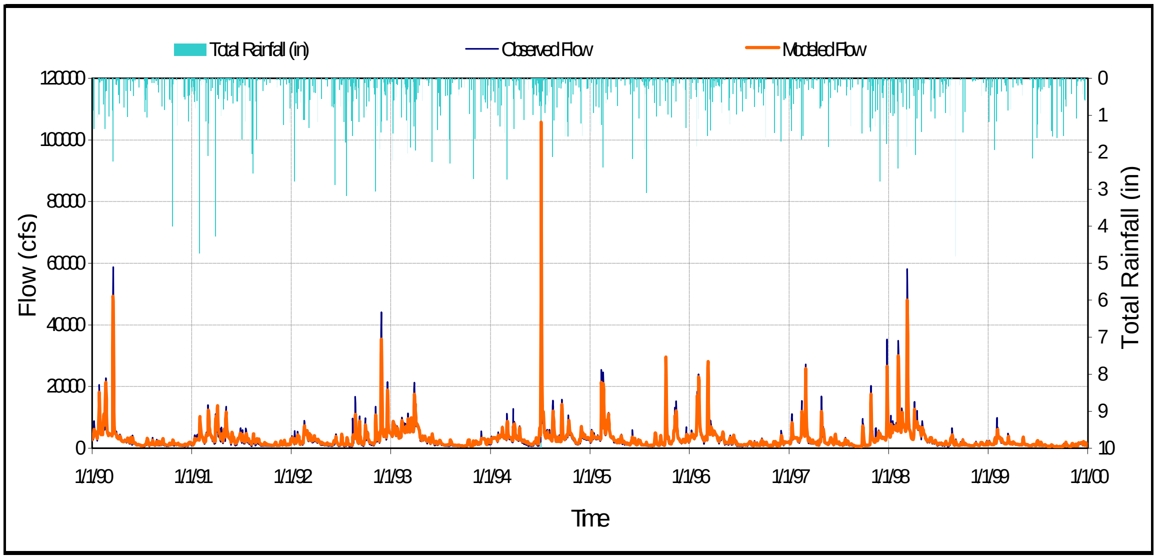

Figure A.29. 10-Year Validation (Daily Flow) at 02213000 – Ocmulgee River at Macon, GA.

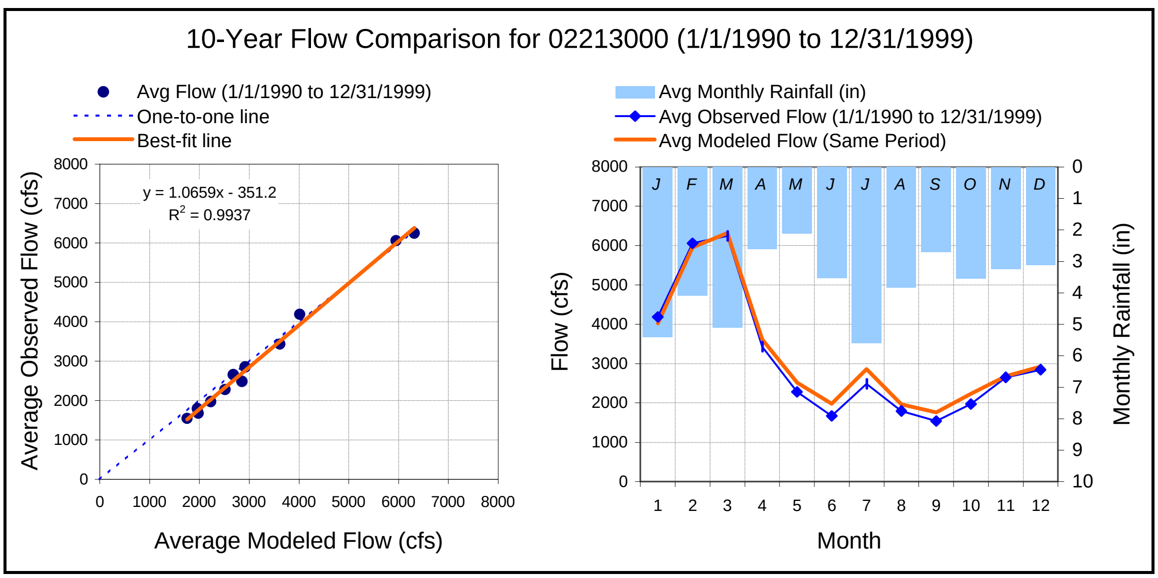

Figure A.30. 10-Year Validation (Monthly Average) at 02213000 – Ocmulgee River at Macon, GA.

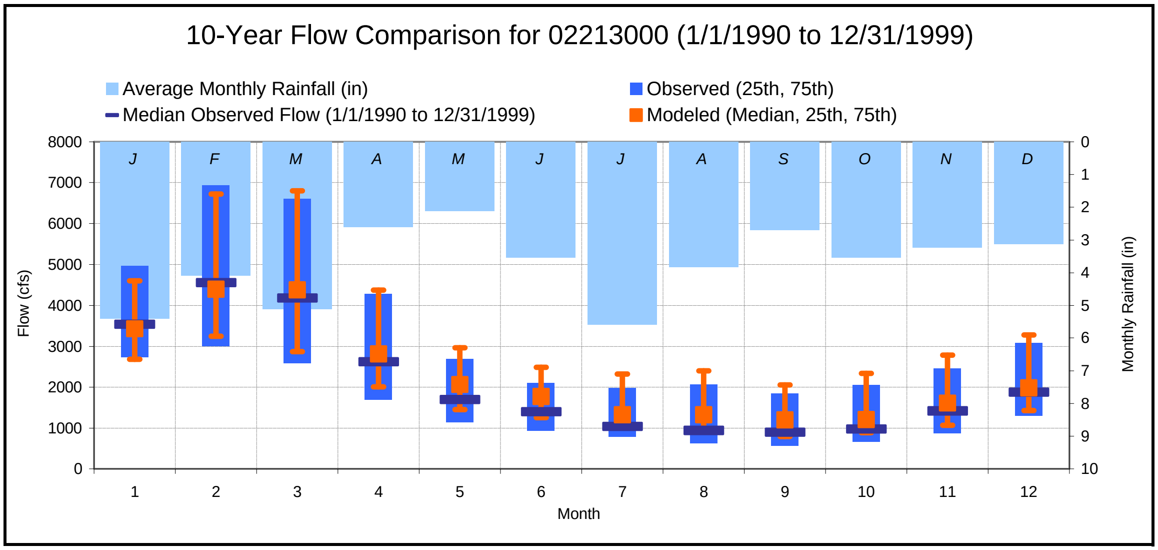

Figure A.31. 10-Year Validation (Monthly Medians) at 02213000 – Ocmulgee River at Macon, GA.

Simulation Name:	02213000	**Simulation Period:**	
		Watershed Area (ac):	1450880
Period for Flow Analysis			
Begin Date:	**01/01/90**	**Baseflow PERCENTILE:**	2.5
End Date:	**12/31/99**	*Usually 1%-5%*	
Total Simulated In-stream Flow:	**193.01**	Total Observed In-stream Flow:	**184.66**
Total of highest 10% flows:	**69.82**	Total of Observed highest 10% flows:	**72.06**
Total of lowest 50% flows:	**38.75**	Total of Observed Lowest 50% flows:	**31.13**
Simulated Summer Flow Volume (months 7-9):	**33.16**	Observed Summer Flow Volume (7-9):	**29.35**
Simulated Fall Flow Volume (months 10-12):	**39.39**	Observed Fall Flow Volume (10-12):	**37.54**
Simulated Winter Flow Volume (months 1-3):	**80.11**	Observed Winter Flow Volume (1-3):	**81.07**
Simulated Spring Flow Volume (months 4-6):	**40.35**	Observed Spring Flow Volume (4-6):	**36.70**
Total Simulated Storm Volume:	**154.66**	Total Observed Storm Volume:	**157.23**
Simulated Summer Storm Volume (7-9):	**23.59**	Observed Summer Storm Volume (7-9):	**22.55**
Errors (Simulated-Observed)		*Recommended Criteria*	Last run
Error in total volume:	**4.33**	10	
Error in 50% lowest flows:	**19.67**	10	
Error in 10% highest flows:	**-3.21**	15	
Seasonal volume error - Summer:	**11.50**	30	
Seasonal volume error - Fall:	**4.71**	30	
Seasonal volume error - Winter:	**-1.20**	30	
Seasonal volume error - Spring:	**9.03**	30	
Error in storm volumes:	**-1.66**	20	
Error in summer storm volumes:	**4.41**	50	

Figure A.32. 10-Year Validation Statistics at 02213000 – Ocmulgee River at Macon, GA.